

From the ...



ON THE USE
OF THE
GRADUATED BATH
FOR THE
REDUCTION OF HIGH TEMPERATURE
IN FEVERS,

WITH AN ANALYSIS OF, AND REMARKS ON,

SIXTY CASES OF ENTERIC FEVER TREATED IN ST. THOMAS'S
HOSPITAL IN THE AUTUMN OF 1877 AND THE
WINTER OF 1877 TO 1878.

BY WILLIAM M. ORD, M.D. LOND., F.R.C.P.,
PHYSICIAN TO THE HOSPITAL.
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PART I.—*Analysis of Cases of Enteric Fever.*

IN connection with the subject of the treatment of high temperature in fever and acute rheumatism by graduated baths, a short review of the cases of enteric fever treated in the hospital during the past autumn and winter may be of some interest and use for reference. The occurrence of a somewhat considerable outbreak of enteric fever has, in fact, given the opportunity of using the baths in such a way as to allow of making some trustworthy deductions as to their therapeutic value. The cases observed have also offered several points worthy of being recorded.

From the end of July, 1877, to the end of March, 1878, 60 cases of enteric fever have come under treatment, and have been distributed as follows among the physicians:—To Dr. Bristowe 24, Dr. Murchison 14, Dr. Stone 11, Dr. Ord 11.

The admissions were chiefly in the autumnal months, by far the greatest number in October, as is seen in the annexed table.

TABLE 1.—*Admitted in each month.*

August	.	.	.	.	6
September	.	.	.	.	7
October	.	.	.	.	23
November	.	.	.	.	10
December	.	.	.	.	7
January	.	.	.	.	4
February	.	.	.	.	1
March	.	.	.	.	2
Total					60

Of the 60, 32 were males, 28 females.

The ages varied from 7 months to 52 years. They are here tabulated :

TABLE 2.—*Ages of Patients.*

Under 5 years.	5-10 years.	10-15 years.	15-20 years.	20-30 years.	30-40 years.	40-50 years.	50-60 years.
2	5	11	16	18	6	1	1

The fatal cases were 8 in number, making 1 in $7\frac{1}{2}$ cases, or 13.33 per cent.

The ages of those who died were 5, 10, 19, 19, 21, 22, 34, and 36 years respectively.

The total of deaths among cases admitted or treated for enteric fever was 9. But inasmuch as one of those died from typhus contracted from another patient during the subsidence of enteric fever, and as the enteric attack was proceeding in all respects favorably when the second disease made its invasion, the death is not included among those forming the basis of the percentage calculation. The notes of one of the other fatal cases have been removed, and are not accessible at the time of writing, but should they fall into my hands will be placed in a short abstract at the end of the paper.

Well-marked relapses occurred in nine cases, but it is

probable that one or two of the cases admitted were actually relapses after mild primary attacks.

As regarded the commencement of illness there was an unusual definiteness in the symptoms. Shiverings, attacks of headache, vomiting, diarrhœa, or bronchitis commonly marking the access. There was, as might be expected, a considerable variation in the probable duration of the illness before admission in different cases, and as such variations affected the extent to which certain symptoms, the eruption in particular, could be observed, I have drawn up the following table.

TABLE III.—*Table of duration of illness previous to admission.*

In 11 cases	5 days and under.
„ 22 „	from 6 to 10 days.
„ 18 „	„ 11 to 15 „
„ 0 „	„ 16 to 20 „
„ 4 „	„ 21 to 30 „
„ 2 „	over 30.

In one case the patient was attacked while under treatment in the hospital, 16 days after admission.

The termination of fever, marked by the resumption of normal temperatures, and calculated from the probable date of access, varied to a remarkable degree.

TABLE IV.—*Table of duration of febrile state in cases of recovery, stated in weeks in thirty-eight cases.*

Recovery in 1st week . . . 0	Recovery in 6th week . . . 16
„ 2nd „ . . . 2	„ 7th „ . . . 2
„ 3rd „ . . . 4	„ 8th „ . . . 1
„ 4th „ . . . 10	„ 9th „ . . . 1
„ 5th „ . . . 9	„ 10th „ . . . 3

Only 38 cases are here tabulated, several complicated cases, as well as the fatal cases, being omitted.

Death occurred on the 15th, 25th, 29th, 33rd, 37th, and 114th day in cases where the date of commencement was known. In one other it occurred, probably on the 38th day. In the two remaining no trustworthy data could be obtained, the patients being delirious from the time of admission.

No data bearing on the period of incubation are available.

The average stay in the hospital was about 5 or 6 weeks, 8 patients going out in the 5th, 11 in the 6th week; but one was discharged within the first week, and on the other hand another stayed 143 days.

Eruption.—In many of the 60 cases a distinctly marked eruption was present at the time of admission. In 17 of such cases the commencement of illness was well-enough defined to allow of inference as to the day of illness on or before which the eruption appeared.

In 1 case admitted on the 5th day the eruption existed at admission, and in this case the spots continued to appear during 14 consecutive days, final disappearance occurring on the 15th day, or 19th of the illness.

In 9 out of the 17 the eruption was present on the 7th day, and the duration afterwards was from 5 to 10 days. In 1 on the 8th, lasting 9 days; in 1 on the 9th, lasting 6 days. In 2 on the 14th; not observed later. In 2 on the 15th, with, in one of them, duration of 5 days. In one on the 21st, lasting 7 days. This was probably a case of relapse.

In 10 of the cases, therefore, the eruption had appeared on or before the 7th day, and the general subsequent duration was to a day between the 12th and 20th, mostly to the 14th or 15th day.

In several cases no note of rash is to be found, nearly all these having been admitted after the 14th day of illness. In two very mild cases, however, admitted on the 3rd and 7th days respectively no rash was observed.

In 13 cases the appearance of rash after admission was noted.

In one case the rash appeared on the 4th day and lasted 14 days.

In one case where the illness began after admission for another ailment, the rash came out on the 6th day and lasted 7 days.

In one case the rash appeared on the 6th day, and lasted one week; and again on the 28th day, lasting 5 days. This was clearly a relapse.

In two cases on the 8th day, lasting 2 and 4 days respectively. In 2 on the 9th, lasting 3 days in one, 1 in the other. In 2 on the 10th, lasting 3 and 10 days. In one on

each of the 11th, 16th, 17th, and 33rd days; that of the 11th lasting 10 days, of the 16th 2 days, of the 17th 11 days respectively, while in the last case the duration is not noted; but this and the preceding were both probably relapses.

Here with a date of commencement varying from the 4th to the 16th day of the fever, the rash lasted to a period varying between the 10th and the 21st, namely, to the 10th in 2, to the 12th in 3, to the 13th in 2, to the 18th in 2, and to the 20th and 21st in 1 severally.

Temperature.—Although this subject will be subsequently discussed in relation to the treatment by the graduated bath, some statement of the general course of the curves may be now given with advantage.

The following Table gives the highest evening and lowest morning temperature, and the average daily variations in each week of the disease, in all of the cases in which the records were available.

TABLE V.—Showing highest evening and lowest morning temperature

Case.	Highest evening temperature.	Lowest morning temperature.	1st week, average.			2nd week, average.			3rd week, average.			4th week, average.			5th week average.	
			M.*	E.	V.	M.	E.	V.	M.	E.	V.	M.	E.	V.	M.	E.
1	105·3, 27th day	99·6, 21st day	...	...	...	...	...	...	102·4	103·1	·7	101·6	102·7	1·1	...	...
2	104·8, 21st	97·0, 27th and 34th	...	...	...	...	...	...	...	...	...	99·4	103·2	3·8	98·2	98·
3	104·6, 3rd	96·6, 16th	103·5	104·5	1·0	102·4	103·4	1·0	97·5	98·9	1·4	97·5	98·8	1·3	...	...
4	105·6, day of admiss., 18th	96·0, 51st	...	...	...	101·9	103·6	1·7	103	104·2	1·2	103·0	104·5	1·5	100·2	102
5	103·4, 4th	96·4, 21st	99·3	101·5	2·2	97·2	97·8	·6	97·8	98	·2	...	...	...	...	...
6	105·4, day of admiss., 21st	96·2, 46th	...	...	...	...	...	...	...	...	...	101·3	103·4	2·1	100·3	103
7	104·2, 21st	96·0, 16th	...	...	...	99·5	102·9	3·4	97·2	98·8	1·6	97·7	98·5	·8	...	...
8	105·6, 11th	97·0, 25th	...	...	...	103·0	104·6	1·6	101·2	103·1	1·9	98·6	99·6	1·	99·1	101·
9	105·0, 18th	96·1, 35th	...	...	...	...	...	...	102·2	103·8	1·6	100·2	103·2	3·0	97·8	100·
10																
11	103·8; day of admiss., 6th	96·0, 11th	...	...	...	98·1	100·3	2·2	96·8	97·3	·5	97·8	98·4	·6		
12	105·2, 10th	97·8, 17th	...	...	...	99·4	104·7	5·3	98·6	...	...	98·6	...	...	...	...
13	103·8, day of admiss., 14th	97·2 and 96·5, 18th	...	...	...	...	...	...	98·3	98·9	·6	...	...	...	...	...
14	103·5, 12th	96·9, 37th	...	...	...	..	...	...	101·2	102·5	1·3	98·2	99·7	1·5	97·5	98·
15	105·8, day of admiss., 6th	97·4, 37th	...	...	...	...	...	...	...	104·3	...	99·0	101·9	...	100·4	103
16	104·6, 16th	96·0, 32nd	...	...	...	100·9	102·3	1·4	100·1	102·4	2·3	97·6	98·1	·5	98·2	98
17	105·4, 30th	96·7, 61st	...	...	...	102·4	104·1	1·7	100·4	102·4	2·0	102·2	104·0	1·8	101·6	102
18	104·4, day of admiss., 4th	96·7, 20th	4 days.			102	102·6	·6	99·0	101·6	2·6	97·5	98·7	1·2	98·3	97·7
19	106·8, uncertain day	97·6, same day	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20	104·4, 5th	97·0, 36th	101·4	102·9	1·5	98·1	99·5	1·4	99·4	100·8	1·4	97·9	98·7	·8	98·7	99
21	103·8, 11th	96·4, 26th	...	...	...	100·0	102·9	2·9	98·8	102·8	3·4	97·2	98·2	1·0	97·9	98
22	105·5, 8th	96·6, 21st	...	...	...	102·7	104·2	1·5	99·9	101·5	1·6	97·6	98·6	1·0	101·3	103
23	105·2, 30th	97·2, 36th	...	...	...	103·2	104·2	1·0	100·9	102·6	1·7	101·3	103·6	2·3	100·5	103
24	101·8, 6th	95·4, 34th	...	...	...	97·9	100·5	2·6	97·3	98·7	1·4	98·2	98·4	·2	98·1	99
25	103·6, 16th	97·2, 44th	...	...	...	...	...	...	99·7	102·3	2·6	98·7	100·3	1·6	98·6	98
26	103·8, 32nd	96·6, 39th	...	...	...	99·1	102·5	3·4	98·3	102·5	4·2	98·8	102·6	3·8	97·7	100
27	103·8, day of admiss., 14th	95·5, 21st	...	...	...	...	...	...	98·9	101·7	2·8	97·6	98·1	·5	98·0	98
28	102·6, 30th	96·0, 41st	...	...	...	...	...	...	97·4	99·1	1·7	97·6	97·6	·0	99·6	101
29	105·6, 6th	101·9, 14th	103·6	105·3	1·7	103·1	104·3	1·2	...	...	...	...	...	...	...	...

* M. Morning, 8 o'clock.

E. Evening, 8 o'clock.

V. Variation.

a weekly averages of evening and morning temperatures and variations.

1st week, range.		7th week, average.			8th week, average.			9th week, average.			10th week, average.			Remarks.
E.	V.	M.	E.	V.	M.	E.	V.	M.	E.	V.	M.	E.	V.	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	Heart disease; temp. went up to 104·8 shortly before death.
98·0	·3	98·0	98·4	·4	98·0	98·0	0	98·6	101·0	2·4	99·6	99·2	·4	The rise in 9th week, not a relapse; œdema without albuminuria.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	Occurred in hospital after pneumonia; alleged typhoid four months before.
99·4	1·2	...	...	...	...	...	...	...	...	...	...	...	...	Seven baths and subsequent spongings; good results.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	Evening lower on three days in 2nd week; mild.
100·1	1·9	98·0	99·2	1·2	101·0	102·4	1·4	99·1	100·3	1·2	...	97·6	...	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	Sudden fall of morning temp. on 9th day, as low as 98·4.
100·3	2·1	98·2	98·3	·1	...	...	...	...	...	...	...	...	...	Relapse on 31st day, after enema.
98·8	2·0	97·3	98·3	·1	...	...	...	...	...	...	...	...	...	Bath, Oct. 24th; temp. 105·0; reduced by bath to 100·6.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	Temperature observations imperfect after 2nd week.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	The variations in this week were very wide, although the average indicates little difference; the extreme range was 7·3.
99·5	1·5	97·3	98·1	·8	...	...	...	...	...	...	...	...	...	Sudden rise in 6th week (to 101·6), after enema.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	Temperature sheet lost; bath.
99·8	1·0	100·1	98·4	1·7	97·5	98·0	·5	...	...	...	...	...	...	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	
99·6	1·1	...	...	...	...	...	...	...	...	...	...	...	...	Daily variations noted in separate report of case.
103·8	1·4	98·6	100·6	2·0	98·3	98·7	·4	...	...	...	...	...	...	
100·8	2·1	98·8	99·6	·8	...	...	...	...	...	...	...	...	...	Relapse, with rigors and fresh spots.
97·3	1·1	...	...	...	...	...	...	...	...	...	...	...	...	
98·8	·4	...	...	...	...	...	...	...	...	...	...	...	...	
99·2	1·0	...	...	...	...	...	...	...	...	...	...	...	...	
99·7	2·1	96·5	97·0	·5	96·5	97·7	1·2	...	...	...	...	...	...	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	It is to be noted that under the influence of baths the temperature fell as low as 98·0, but only for a short time.

[illegible]

The highest temperature registered in any of the cases was 106.8° . This was reached two days before death in a case which ended fatally by perforation, and was followed within a few hours by a fall to 97.6° . In this case the temperature (axillary) stood at 103.6° one hour before death, at 101.6° fifteen minutes after death, and at 103° one hour after death. The patient, a French *bonne*, was delirious when admitted, and no trustworthy dates of her illness before admission could be obtained.

The lowest temperature was 93.8° . It occurred on the ninth day of fever, and was related with severe hæmorrhage. The patient recovered.

It will be seen on a survey of the above table that the temperature reached or exceeded 106° Fahr. in 2 cases, both of which were fatal, one by perforation, the other by hæmorrhage. In one case of relapse treated by bath, however, the temperature rose one morning to 106.2° . This is not included in the list as it was a sudden irregular rise. The case, which ended in recovery, is described among the relapses. In another case of mild fever in a child of 7 months, where the total duration was only 15 days, the temperature was at 106° , when the child attended at the hospital four days before admission. In 19 cases, or nearly one-third, the temperature rose to 105° , or to between 105° and 106° Fahr. In 15 cases to 104.0° and less than 105.0° . In 51 cases to 103° and less than 104° . That is to say in 51 cases out of 60 the temperature reached 103° or upwards. In 4 fatal cases the highest temperatures were 105.0° , 105.2° , 105.3° , and 105.6° respectively. In 2 remaining fatal cases 104.3° , and 104.8° respectively.

There was great variety in the period of the illness at which the highest temperature occurred.

In the first place the temperature was higher on the day of admission than on any subsequent day in 18 cases out of the 60. This of course does not prove that the temperature had not been higher on previous days. And an influence which has been pointed out by Dr. Charles, our present and most able Medical Registrar, must be kept in view. Dr. Charles has after collection of temperatures, observed that patients almost invariably cool a little—from $.5^{\circ}$ to 1.5° —within a few hours of their admission; the higher temperature observed at the time of admission having

probably been a rise caused by the excitement and fatigue incidental to the transit from home to hospital.

Of the 18 cases in this category 8 were in the first week of fever, and their average highest temperature was 102.9° . Eight more were in the 2nd week, with an average aeme of 104.29° ; one on the 21st day, 105.4° ; one on the 28th day, 106.4° . The last two were relapses.

Of 37 other cases in which the aeme was attained after admission, 8 were in the first week, with average of 103.5° ; 8 in the 2nd, with 104.55° ; 6 in the 3rd, with 104.36° ; 6 in the 4th, with 104.5° ; and 6 in the 5th, with 104.4° . One reached it on the 40th day, with 104.2° , and one on the 50th, with 103.5° .

The average of the evening temperatures was in the non-relapsing cases, and in the first attack of relapsing cases highest during the second week of the disease. And as regards the relation of morning temperatures, it is evident that the early appearance of marked remissions invariably indicates a mild attack. In several cases the evening temperature fell below that of the morning during convalescence. The course of the temperature in cases of relapse is indicated in the table, but will be more fully traced when the subject of relapse comes under notice later on.

Pulse.—A rate of 160 was recorded in three cases, all fatal, in all not long before death. The extreme rapidity of the pulse did not correspond with the highest range of the temperature. In one case 150 was noted, coinciding with a temperature of 106.2° . Recovery followed the treatment by bathing. The pulse rose to 140 or upwards in 4 cases. Three of these were severe, one, in a child, not severe. Only in one of the four did the high pulse coincide with the highest temperature. This was during a rigor. In 9 cases 130 and upwards, in 10 cases 120 and upwards were registered. There was a general relation between high pulse and high temperature. But there was not an exact correspondence. Where a high pulse—by which I understand 120 and upwards—continued for several days, the evening temperatures during that time were always high. Thus, in one instance, a pulse of 120 was maintained with rare occasional falls during 6 weeks, in association with a temperature not exceeding 104.4° , but constantly near it. On the other hand, many sudden rises of the pulse were not accompanied by

rise of temperature. This is of course what might be expected, many circumstances of a temporary duration being capable of sending up the pulse, while they do not tend to raise the temperature. Simple quickness of pulse does not produce, nor is of necessity associated with, a high temperature. Again, in a number of cases where both temperature and pulse were high during the progress of the case, the highest pulse and the highest temperatures occurred at different dates, often many days apart, the high pulse sometimes preceding and sometimes following the high temperature. In several cases where the temperature ran high the pulse was only moderately affected. For instance, in one case where a temperature of 105° was reached, and where the average evening temperature of the 4th week was 103.2° , the pulse remained at 96 except on one occasion, when it rose to 110 without any change in the temperature. Finally, in 18 cases of enteric fever, where the temperature reached 105° or upwards, the average highest pulse was as near as possible 131. Of these 5 were fatal cases, including the three already alluded to, in which the pulse reached 160. Excluding the fatal cases, the average highest pulse was 123. In 31 cases, where the temperature was less than 105° , the average highest temperature being 103.5° , the average highest pulse was 105. These cases include two deaths, but in one of them the death was due to subsequent typhus attacking the patient when fairly convalescent from typhoid. The other was a case in which the patient died after amputation for gangrene of the foot. Although a temperature of 104.3° was not exceeded, the pulse ranged at 126 for some time, and when gangrene set in rose to 136.

The general results here agree with what is generally taught with regard to the pulse in enteric fever; that, other things being equal, a pulse of 125 to 130 gives rise to anxiety, and that a pulse decidedly above 130 means danger.

Diarrhœa.—The epidemic of the last autumn and winter, so far as it was illustrated in this hospital, was remarkable for the slight severity of the diarrhœa in most of the cases. More than this, diarrhœa is definitely recorded to have been absent in 22 cases out of 57, and was in nearly all these replaced by constipation requiring the use of enemata or laxatives. The remaining 35 cases are classified in three groups, not severe, severe, and very severe.

The term severe is used where 4 or more motions have been passed daily, very severe where the number has exceeded 7 during several days. Twenty-one (21) cases are placed under the head of "not severe," 12 under "severe," 2 under "very severe," both of which were fatal. Of the "not severe" 4 cases followed the use of laxatives, eight so-called "antibilious" pills being taken by one patient; and in 5 cases diarrhœa was absent during the primary attack, but was present with more or less severity in a relapse. If diarrhœa was not generally a marked symptom, constipation was common, was troublesome, and played an active part, as it appears to me, in the production of recrudescence, the measures used to relieve it, or the resumption of action after inertia being frequently followed by return of all the symptoms of enteric fever—by relapse or recrudescence.

Constipation, requiring the use of laxative medicines or enemata, occurred in no less than 38 of the cases, sometimes from the beginning to the end, in a few instances before diarrhœa, in many after the cessation of diarrhœa.

Vomiting is noted as having been a prominent symptom at the access of fever in 24 cases. In two cases it was so severe during the course of the fever as to be a serious complication, and in one case severe vomiting introduced the symptoms of perforation, if indeed it was not the actual cause of the accident.

Abdominal conditions.—Marked distension of the abdomen existed in 18 cases, amounting in 5 of them to tympanitis; general pain and tenderness in 34, the intensity varying, and for the most part not great. In 24 cases there was pain or tenderness in the right iliac fossa, in 5 in the epigastrium. "Gurgling" on pressure in the right iliac fossa was noted in 5 cases without the accompaniment of pain or tenderness. There was the general signs of acute peritonitis in 4 cases.

Note of the condition of the spleen was made in 30 cases. In 18 it was enlarged, in the remainder not. In 5 cases there was distinct tenderness over the spleen as apart from other organs.

Tongue.—The tongue is described as having been dry and brown in 14 cases. But this condition was constant for any long period only in two cases, and here in conjunction with complications—retention of urine and pleurisy. In the rest

the condition marked the height of fever, and is stated more than once to have passed away after the use of a bath. The furred whitish or yellow surface, with red tip and edges, is noted in 30 cases. In several of these the centre is described as becoming dry and cracked, and either brownish or unnaturally red. The "glazed" tongue is noted in a few severe cases, and three times tremor is mentioned. Distinction is to be drawn between this and the slight tremor coming on late in the fever and due to weakness, where the trembling has a wavy character. This may or may not have occurred in many cases. The tremor here spoken of is a rapid irregular movement of the whole organ, giving the appearance of a state of terror, and very much resembling the tremor of the tongue in delirium tremens. Such a tremor attended the earlier stage of the three cases quoted, and was followed in all by symptoms indicating great depth of ulceration, marked pain, tenderness, diarrhœa, or hæmorrhage, and by a strong tendency to relapse. In a few cases the tongue was little changed, merely becoming large and soft, with a thin whitish or yellowish coating. In one case, of great severity, but ending in recovery, the tongue became aphthous towards the end of the fever. In another case, where very severe diarrhœa preceded death, the tongue, previously brown and dry, became red and raw on the setting in of the diarrhœa, and continued so till the end.

Respiration.—The rate of respiration was very generally quickened. Rarely noted below 24, it was more often between 24 and 30 in the minute, and ran up to 40, 44, and 48 in cases of high fever or severe local affection of the respiratory organs. It is worthy of note that in one case, where the pulse was at 96 throughout, the respiration ranged from 24 to 30 without any obvious cause for such rapidity. In another case the respiration was raised from 24 to 32 by a bath, used to bring down the heat of the body, which acted favorably in every other respect.

Catarrh, demonstrated to exist by such physical signs as rhonchi, wheezings, moist crepitations, râles, &c., without consolidation of the texture of the lung, occurred in 28 cases. Pneumonic affection of the base of one or both lungs was observed in 12 cases, the more severe of which, as passing beyond the limit of the lung affection which belongs to enteric fever, are included

among the complications. Pleurisy, too, will be found under that head, one case only being noted here in which concurrently with a little pneumonia fluid was effused into the right pleura.

Hæmoptysis, again, is noted here only so far as it was symptomatic of catarrhal or pneumonic congestion. This was noted in 4 cases. More severe cases of hæmoptysis are passed on to the complications.

Urine.—No connected notes of the quantity or chemistry of the urine in any of the cases exist. The urine was generally examined on the day of admission, and subsequently only when circumstances drew attention to it. At admission it was usually of high specific gravity, reaching as high as 1038, without the presence of sugar. In 13 cases out of 43 in which this point is noted albumen was present, but in six of these the quantity is spoken of as “a trace.” I may observe that the urine in one or two cases in which it was examined specially for the purpose yielded a very strong indican reaction, a circumstance which agrees with observations made by Senator and others, that in fevers with intestinal complications there is a large excess of indican present in the urine.

Nervous System.—Delirium is distinctly stated to have been altogether absent in 37 cases. Its existence is noted in 16; as “slight at night” in 4, as a “wandering or rambling” in 2, as drowsy delirium in 3, as a noisy delirium in 1, and as an active or somewhat violent delirium in 6, four of which were fatal cases, the violence appearing near the end. The only other nervous symptom recorded is ptosis of the right eye, with dilatation of both pupils, passing off completely after a few days.

Complications.—This subject has, in the study of enteric fever, a great interest. There is no malady, so far as I know, which has so remarkable a property of proving the weakness of its victims. Whether it be the long duration of the process, or the indifferent and feebly specific nature of the infection, or both; whether, that is to say, a long-lasting elevation of temperature blows already existing embers into a blaze, or whether a less imperious specificity lets other processes assert themselves instead of filling the whole field itself, may be a fair question for searching out and answering. But that there is a difference in the whole scope of the complications of enteric as compared with those of typhus or scarlatina appears to me

quite certain. If we put aside the splenic enlargement, the bronchial catarrh, and the abdominal lesions incidental to the characteristic illustrations, we find outside them a large group of complicating lesions, illustrating in one way and another the constitutional weaknesses of a community. In the limited range of our 60 cases abundant instances may be found; and the classification of complications beyond those which belong to the proper natural history of the disease may be made accordingly. First, we may establish a group in which the complications are accidents of the disease, and not related to other diseases, *accidentia* with very little of a *proprium* about them, except so far as they relate to weakness and the general process of fever. Second, a group in which the *accidentia* have a *proprium*, and are related to processes involved in the special febrile process. Third, a group of accidents in the second degree, not *propria* in any sense of the disease, but *propria* of the individuals—*accidentia* of the fever, *propria* of its subject.

In the first group we find

1. Phlebitis, one case. Veins of leg.
2. Gangrene of foot, requiring amputation.
3. Pyæmia, one case.
4. Bedsores, four cases.
5. Retention of urine, six cases, five in males, one in female.
6. Incontinence of urine, one case.

7 (of doubtful position). Tonsillitis, six cases; two simple; one simple, with affection of lymphatic glands; one ulcerative, involving soft palate and associated with glandular inflammation; two exudative, involving soft palate and pharynx, with much glandular inflammation.

These are put "doubtfully" in this position, because on the one hand it is to be remembered that the tonsils have much physiological relation with Peyer's patches; and against this that the throat is easily affected by cold or contagium in weakened persons. On the whole I should be sorry to judge from one epidemic. But in passing I should like to urge the interest which attaches to tonsillitis in relation to rheumatic, scarlatinal, and enteric morbid processes. It is to my mind certain that in families having acute rheumatic tendencies there is a strong proclivity to tonsillar inflammation, *partieu-*

larly of the ulcerative and exudative kinds. And in such people, just as a day of hard work, of continued over-exertion, or excitement will tend to bring on rheumatic affection of joints, so the same causes will produce quinsy. It is the usual custom when a quinsy comes on to infer or assume the occurrence of a chill. But on careful investigation of numerous cases I have been able to eliminate this cause, and so far to throw the real cause further back, to over-exertion and over-heating of the body. It is again certain to my mind that exposure to sewer gas, and like miasmata—to the sort of atmospheric impurity in which enteric fever is generally held to have its origin—frequently produces the same sort of ulcerative or exudative tonsillitis. The circumstances, indeed, often suggest to me that the patient suffering from the tonsillar affection has had either a smaller dose of the enteric poison than is sufficient to produce the true enteric fever, or a dose of poison allied in nature, but slightly different in such a way as to come into relation with a different group of homologous glands. The speculations of my colleague Dr. Harley upon the relation between scarlatina and enteric fever bear upon the affinities here discussed. And if the histories of families are followed out, the existence of groups of persons closely related to each other by descent, and having in common a strong attraction for certain morbid processes of the kind here discussed will be amply suggested. We find in families a proclivity to enlargement of tonsils, to tonsillitis of all three kinds, to acute rheumatism, to feverish attacks without complication, to scarlatina, and to enteric fever—all in severe forms. I have many notes of such family histories, and fresh instances are of constant occurrence. Here ends a large digression, which I could hardly avoid making in explanation of the doubt which possesses me as to the proper position of tonsillitis in the categories which I have endeavoured to establish. Perhaps in these considerations may be found the germs of a future paper.

In the second group may be included :

1. Pneumonia, six cases, with, in one, collapse of lung. Clearly extensions of a process belonging to enteric fever.
2. Pleurisy, three cases. Probably related to the foregoing, though possibly in one case rheumatic, and if so belonging to the next group.

3. Hæmoptysis, marked in two cases.
4. Hæmatemesis, in two cases.
5. Epistaxis, in four cases.
6. Hæmorrhage from the bowels, in five cases.
7. Peritonitis, four cases.
8. Abdominal abscess, one case.
9. Perforation, three cases.

In the last group :

1. Œdema of ankles, occurring suddenly with rise of temperature, but without any signs of renal complication—rheumatic?
2. Endocarditis, in two cases.
3. Pericarditis, two cases, one with inflamed knee, one with peritonitis.
4. Consolidation of apex of lungs, two cases.
5. Otorrhœa, one case.
6. Peritonitis of tibia and fibula, one case.

In one case where there was a history of free living, there was much tremor of muscles, simulating delirium tremens in the outset. The evil augury of the very tremulous tongue has already been alluded to. It is worth noting also that, in the case of patients of intemperate habits, it is not uncommon for the outset of enteric fever to resemble an attack of delirium tremens ; in fact, it may be said that there is an early stage of this kind. Enteric fever thus introduced is almost always fatal, and almost always by perforation. So also acute rheumatism with its cardiac mischief may start up in the early stages of enteric, though rarely to continue ; and tubercular deposits may be quickened into activity, or the tendency to deposit quickened, or syphilitic mischief may be roused from a dormant state.

Treatment.—A special chapter following this will be devoted to the consideration of the use of baths, packs, and spongings, in the treatment of high fever. Here, under the head of treatment, the other remedial measures applied in the 60 cases will be analysed.

A general review of the cases shows that no specific treatment has been attempted. A very large proportion of the cases have been treated purely expectantly ; in a certain proportion effervescing saline medicines ; in a small proportion the mineral acids have been used. This last is indeed the nearest approach to specific treatment that has been made, excepting that in one

instance the salicylate of soda was given late in the disease. In my opinion it is a rational and useful treatment, based upon the undoubted fact that the mineral acids oppose putrefactive and disintegrative processes. Aconite and acetate of ammonia were used, apparently as febrifuges, in one or two cases.

Among the symptoms which in the expectant treatment had to be met, diarrhœa stands out as the most important. The means used for its control have been various, including opium, in form of pill, extract, tincture, and enema; morphia in suppository, Dover's powder, catechu, kino, and acetate of lead.

The extent to which treatment should be opposed to diarrhœa is a subject upon which much diversity of opinion exists. To all appearance a moderate diarrhœa, with not more than three stools a day, is not at all unfavorable, and may be salutary. And when not passing these limits diarrhœa, I submit, should not be the subject of special treatment. The constipation which almost invariably follows the checking of such diarrhœa has more than compensating difficulties and dangers of its own.

When, however, the diarrhœa becomes more profuse, or, what is perhaps more important, the movements of the alimentary canal and the emptying of the rectum become more frequent, new dangers are introduced. The exhaustion produced by the often repeated passage of irritant matters over the surface of the rectum is one element of danger; the inflammatory excitement set up around the neighbourhood of the ulcerated patches is another. The choice of the moment at which interference should take place is not always easy, but must be determined by such considerations as the effects of the diarrhœa upon the general strength, by the occurrence of faintness, nausea or vomiting before or after the stools, by the increase of pain or tenderness in the abdomen, by the presence of blood in the evacuations. As regards the measures to be taken I have no hesitation in expressing a strong preference for remedies applied per anum. The morphia suppositories of the Pharmacopœia, or starch and opium enemata, meet the case better than any other remedies I know of. These have been used a good deal in the treatment of the diarrhœa in the present cases. But no doubt they are not always applicable or convenient, or even otherwise suitable, and among remedies for this symptom used

in these cases are found opium administered by the mouth, as pill, extract, or tincture, its combination with ipceaeuanha, Dover's powder, catechu, kino, and acetate of lead.

Again, in hæmorrhage it appears to me that it is easy to do too much. In many of the really dangerous hæmorrhages the actual bleeding is over when its symptoms are recognised. Treatment here should consist in mitigating the effects upon the general system, and in the endeavour to remove the conditions which have produced it and may do so again. It is not to be forgotten that a hæmorrhage, dangerous though it be for the moment, is often distinctly salutary, as, for instance, where there is general plethora, or where there is great local hyperæmia. One most important object for our constant view is that the treatment be not such as may have any remote influences of an injurious character. Now, I am strongly of opinion that whatever benefit may at the moment of bleeding be gained by the free use of astringents is often more than neutralised by subsequent constipation and involved congestion of the inflamed parts. In the main, therefore, the free use of opium, the application of cold—best by the medium of the ice-bag—to the right lower abdomen, and the administration of stimulants while faintness or extreme exhaustion continue, are the remedial measures which most commend themselves to me. The use of subcutaneous injections of ergotin, or the administration of small doses of turpentine, appears to have been beneficial in more protracted cases, without being open to the objections before urged. But gallic acid, tannic acid, and acetate of lead, are remedies which I should put aside as more hurtful than healing.

In cases where perforation has occurred or appears imminent, or where there are sudden symptoms of acute peritonitis, the free use of opium and the constant application of the ice-bag have been chiefly resorted to. The opium in such cases is borne well, and the ice bag may be used for days together.

In tympanitis with or without intense pain the turpentine stupe has been chiefly used.

And, again, in sleeplessness and restlessness opium has been the drug usually resorted to. Choral was used only once.

In the occurrence of severe vomiting of opium, bismuth subnitrate, nux vomica, ipceaeuanha, hydrocyanic acid, were used, sometimes singly, sometimes in succession.

The use of stimulants is a part of the treatment about which a few words must be said.

It may be stated broadly that the simple stimulating treatment of fever was not adopted in any case; that the use of wine, brandy, or other alcoholic drinks was determined in all cases where they were used by the weakness of the patient or the empty state of the arteries; that for the most part wine was not given till the disease had passed its acme; and that in a very considerable number of cases no alcohol was administered during the stay of patients in hospital.

The following numbers speak for themselves:—Twenty-four (24) patients received no stimulants at all; six (6) only a small quantity during convalescence; eight (8) not any till after the tenth day of admission; twenty-two (22) received them within the first ten days of stay in hospital, or while the fever was in activity, but very few, indeed, received them till after the end of the first week of illness. These results, I confess, have rather taken me by surprise, and illustrate well the extent to which expectant treatment of enteric fever has been carried in St. Thomas's Hospital.

The quantity of stimulant varied from a glass of wine or a glass of beer up to 16 oz. of wine daily in one case, and 8 oz. of brandy in another.

In the matter of diet, the almost invariable prescription was milk and beef tea, the former given in large quantities in the late part of the fever and early part of convalescence. Eggs were given in early convalescence, and then fish; but the use of bread was usually deferred till the motions had been for many days solid. Even then it appeared that the use of bread was followed by rise of temperature, and in one or two cases relapses directly coincided with the resumption of this article of diet. Rightly or wrongly there is a strong belief among the sisters of the hospital that bread is the most dangerous article of diet for patients in convalescence after enteric fever.

Relapse and Recrudescence.

The 15 cases of which, under the above heading, abstracts are given at the end of these remarks were cases in which, after subsidence, more or less complete, of the fever and its attendant symptoms, a recurrence of high temperature of some duration occurred. It may be a question whether in Case 3 the short duration of the recurrence, or in Case 13 the symptoms attending the recurrence quite justify the term relapse, but they are included as contributory to illustration, inasmuch as the question of recrudescence is also here discussed.

Putting aside for the present Case 9, of which the notes were lost, the primary attack was severe or very severe in 8 out of the 14 remaining cases. In 4 of these the relapse was more severe, in 4 less severe than the primary attack. Of the 6 milder primary attacks, 4 were followed by relapses of great severity, in one the primary attack and relapse were of about equal severity, in one the relapse was light, lasting only three days.

The subsidence of the fever after the primary attack was not always to the same extent. It was complete in 7 cases out of the 15. In the remainder it was partial, 2 cases being remarkable for an early abortion followed by severe relapse. The amount of subsidence bore no relation to the severity of either primary or secondary fever.

The relapses varied much in their completeness; but six of them were exactly like primary attacks in their beginning, course, and end. In five of them a second eruption of typhoid spots appeared, and was in all but one of long duration, lasting in one fourteen days, until all other symptoms had abated. The occurrence in Case 15 of a third relapse, attended with typical course of temperature and with a third eruption of spots lasting ten days, is most interesting. All the cases ended in recovery.

Reviewing the whole 15 it may be safely asserted that 9 of them were cases of undoubted relapse, that 1 was doubtful, that the remainder were cases of recrudescence, all of them severe and 2 of them of great intensity. Repeated recrudescence also followed one of the cases of true relapse.

The proportion of true relapses to the total of cases was unusually high, being 15 per cent. The numbers recorded in the observations of various authors vary from 3 per cent. to 10 per cent. To quote Dr. Murchison :—" During seven years (1862-8) relapses were observed in 80 out of 2591 cases in the London Fever Hospital, or in 3 per cent. Griesinger noted them in 6 per cent. of 463 cases at Zurich; Human in 8 per cent. of 548 at Leipzig; and Maclagan in 13 (10 per cent.) of 128 cases at Dundee," 'Treatise on Continued Fevers,' 2nd edition, 1873, p. 551. The occurrence of a third attack or second relapse as in Case 15 is very rare. Dr. Murchison on the same page speaks of only two as having occurred in his own large practice.

The cause of a true relapse is probably to be found in a renewal of the process of ulceration in fresh patches. At all events the weight of opinion is in this direction; but the causes that lead to this renewal are not so readily detected, nor are they the subject of anything like a general agreement. In connection with this matter the characters of the epidemic may be studied. It must be remembered that there accompanied this unusual tendency to relapse a remarkable tendency to constipation rather than to diarrhœa, and a general want of prominence in the abdominal symptoms from a clinical aspect. Dr. Maclagan has endeavoured to account for relapse by suggesting an inoculation of fresh glands and has asserted that in cases of relapse constipation has occurred by which time, and therefore opportunity, would be given for the second infection. But to this it may be objected that in primary attacks the lowest patches of Peyer, those nearest the ileo-cæcal valve are the most advanced in the morbid process, and that the highest affected, those further from the valve are the least advanced. And in fatal cases of relapse the fresh lesions are in my more limited experience, which is to the same effect as Dr. Murchison's, situated higher up the intestine than the old.

In the present series of cases I am inclined to associate the relapses, at least in part, with the tendency to constipation. This, again, is a condition to be explained. Sir William Jenner has expressed an opinion that diarrhœa is not common in enteric fever unless there be much affection of the solitary glands in the large intestine as well as of the patches of Peyer.

All that one sees in the cases under notice is confirmatory of this opinion. Now constipation almost inevitably forms the alternative of diarrhœa in people confined to bed, and on a scanty diet. It is to be noted that in the fatal cases submitted to post-mortem examination the small intestine almost always contained hard or, at least, solid matters of clayey substance and angular form resting on the ulcers, and apparently chargeable in some instances with the perforation which caused death. It is, therefore, a plausible solution of the relapses that they were caused by a fresh poisoning of the system consequent on the retention of the infectious matter in the bowel in contact with raw surfaces. To accept this, however, is, as Dr. Murchison says, to accept another argument against the specificity of enteric fever.

Is it possible to find another solution either in the necessity for aperients, and consequent irritation of the bowels, or in the excitement necessarily set up when the bowel after long quiescence contracts on the accumulated feces, and denuding the surfaces beneath, sends lump after lump of solid matter over a long series of fresh raw surfaces? Is it possible that without further infection this may set up a process of irritation, causing a fresh outbreak of inflammatory action along the line of patches and determining ulceration in follicles already infarcted, but not sufficiently to cause sloughing? It is noteworthy that in seven cases the relapse followed immediately on the use of enemata or castor oil for the relief of constipation. Such an explanation as this appears to me to be consistent with the early overlapping relapse occurring in some abortive cases before the sloughing would be accomplished, a slight and imperfect explosion being converted into a decisive one by fresh irritation of a non-specific kind. Tonsillitis may be cited as showing some parallel phenomena. Severe tonsillitis with ulceration of the surface, and lymphatic infarction of the follicles leading to suppuration, is as my observation goes most commonly produced by poisoning of the system. It is a morbid phenomenon of constant occurrence in houses and localities where the conditions favorable to the spread of typhoid exist; and again in a multitude of instances it follows chill, but still preceded by excessive and prolonged, or in some way unusual, muscular exertion, particularly in hot weather;

when the result of the chill is to prevent the excretion of the results of the exertion and heat by the ordinary channels ; when the system is self-poisoned. Again, the process occurs under the same circumstances of heat and exertion without the chill, when the system appears to be poisoned by an excess of excretory matter beyond the purgative power of the proper channels. In such cases relapses or recrudescences are rather the rule than the exception, successive suppurative explosions occurring after intervals of almost complete resolution of the local morbid activity. If the parallel be admitted the idea of the specificity of enteric fever must be still further surrendered, but at the same time a type of morbid process lying between this imperfectly specific disease and non-specific diseases is introduced. The relation is of some importance in its bearing upon the hypothesis that the various morbid poisons of specific kind have their origin as "sports" of germs existing around and possibly within us.

While the speculations raised by these cases as to the nature of morbid processes cannot be decisively judged, certain points in treatment have to be considered. They are questions, 1st, of the treatment of diarrhœa and constipation ; 2nd, of diet. I have already expressed the opinion that to check the diarrhœa of enteric fever unless the frequent repetition of stools obviously produces exhaustion is unwise. But I have of late had reason to doubt whether a practice of non-intervention in the case of constipation may not be equally unwise. From a fear of producing diarrhœa or setting up irritation, I have hitherto followed the practice commended by many authors of note of not being hasty to remove constipation. It has been my rule to allow at least six days to pass without stools before using aperients ; and then I have had recourse to enemas, or, when they failed to produce effect, to castor oil. That relapse has appeared to follow such practice and that recrudescence has certainly followed in several cases is certain. That the examination of the bowels in fatal cases points to danger arising from the formation of lumps of fæces in the rectum must be acknowledged. Hence arise certain critical inquiries. First, should constipation be allowed to continue long enough to give opportunity for the formation of lumps of fæces in the small intestine ? Second, by what remedial measures is constipa-

tion to be obviated or relieved? Most probably the accumulations begin in the affected bowel before constipation becomes a symptom. The large intestine may be slowly expelling its contents, while the muscular torpor of local inflammation may be allowing solid deposits to occur in the small intestine. But if active peristalsis be set up in the large intestine, as may be often effected by stimulation of the rectum and anus, action may be expected to be set up in the small intestine also. My conclusion is that constipation should not be allowed to continue for more than three days without some treatment. In many cases a simple enema suffice to set going all the activity of peristalsis in large and small intestine that is necessary. When this does not suffice, castor oil in small doses, or sulphate of magnesia with small quantity of dilute sulphuric acid, are the remedies which seem most appropriate.

As regards diet it is probable that an early recourse to starchy food of the solid kind is injurious. By this is understood bread, or the slightly swollen starch in puddings of various kinds, as opposed to starch in the fully swollen or mucilaginous state. Bread in particular given early in the disease appears to be decidedly incendiary. The administration of beef tea and other meat juices, with a moderate proportion of milk, followed in later stages by the addition of egg-foods, with starch only in the mucilaginous form, seems to me the safest kind of dieting. The plan agrees with the teaching of some of the earliest observers and writers on this disease, and I only mention it because the experience of many officers of the hospital as to the injurious influence of the solid starches when given before convalescence is clear on this point and unmistakable.

Abstract of cases of Relapse and Recrudescence in Enteric Fever.

1. S. C.—. æt. 24, female, married, admitted to Alice Ward under Dr. Bristowe 29th August, 1877.

The primary fever had been apparently in existence for three weeks at the time of admission. No eruption was observed, a

fact which increases the probability of the above estimate. The highest temperature (105.4°) was noted on the day of admission, and thence the fever gradually declined till the end of the third week after admission, when it became normal. The primary fever thus lasted six weeks, without much diarrhœa or noticeable complication, but with most characteristic temperature curve. On the 26th September (seventh week) the temperature suddenly rose, reaching, two days after, 103° , and remained high in the evening with marked morning remissions for two weeks.

The high temperature was not accompanied by diarrhœa or increase of pain, but after the bowels, previously confined, had been opened by enema. There had been no change in diet. After the subsidence of the second fever there occurred a little diarrhœa. The patient was at that time allowed to be up for a few hours daily, and it was not necessary to confine her to bed. The diarrhœa was checked by compound powder of kino.

2. A. W—, æt. 20, female, married, admitted to Alice Ward, under Dr. Ord, 18th September, 1877.

Ill nine days before admission. Eruption appeared the day after admission and lasted ten days. The highest temperature on September 20th (eleventh day) 105.6° . Moderately severe diarrhœa (one to three stools a day) began on 20th and lasted thirteen days. Fever subsided in third week of stay, about twenty-sixth day. The graduated bath was used on the second day after admission, and again two days later, with the effect of subduing the high temperature. The tongue it may be noted was tremulous on the 20th.

The bowels were not relieved from October 2nd to October 10th, when a simple enema was ordered. The action of this was followed by diarrhœa and increase of temperature lasting a fortnight. There were no spots, and the heat was not so great as in the first attack. No error in diet or unusual exertion is known to have occurred.

3. A. W. H—, æt. 31, male, clothier, admitted to Charity Ward, under Dr. Ord, 2nd October, 1877.

This patient was admitted on the eleventh day of illness and passed through a characteristic, but not severe, primary attack. The eruption was slight, there was no diarrhœa, but at the time of admission the patient was in a state of drowsy delirium.

The temperature fell to normal in the third week of admission, but in the fifth (sixth of illness) rose suddenly in the evening to 101° , and did the same for three days in succession, with sharp rigors, then it dropped as suddenly to 96.9° , and gradually returned to normal level. This rise, which may be characterised as a partial relapse or reerudescence, followed directly the use of an enema, and, with an interval of two days, the addition of suet pudding to the fever diet. It must be remarked, however, that enemata had been used twice before at intervals of seven days.

4. E. S—, æt. 22, female, married; admitted to Alice Ward, under Dr. Ord, 2nd October, 1877.

Ill six days before admission. Eruption present on day of admission, lasting a week. The primary attack was very severe, the temperature rising to 105.8° on the day of admission; and, although there was not much diarrhœa, the abdomen was distended and painful. The tongue was furred, red at the edges, and tremulous, and the urine scanty and of high specific gravity—1030.

After the use of baths on admission the fever was checked, and in the third week of the fever the temperature had fallen considerably and approached the normal standard, but in the fourth week there was a rise of morning and evening temperatures, giving an average of 103.3° for evenings. Fresh spots appeared on the 23rd October—end of fourth week, or five days after fresh rise—and continued to appear till the 29th. Pain in the abdomen also returned. The salicylate of soda was prescribed in moderate doses when the rise occurred, and some Dover's powder was added two days later. In this case no cause external to the patient was known to account for the relapse. Neither aperient, enema, nor change of diet had been ordered, and it was not till the 2nd of November when, the second attack had completely passed away, that even bread and butter was allowed.

5. W. D—, æt. 15, male, printer, admitted to Charity Ward, under Dr. Bristow, 4th October, 1877.

The patient had been ill fourteen days, and at the time of admission his temperature was high, giving an average in the week of 104.1° for the evenings, with but small remissions. There was an appearance of eruption on one day only, the fourth after admission. The spleen was much enlarged and

the abdomen tender, but there was no diarrhœa. The next week saw the fever and all its attendant symptoms much reduced. But in the fourth week—sixth of the disease—came a rise of the temperature to a height above that of the first week, and an exacerbation of all symptoms, save of the abdominal pain. On one evening 105.4° was registered, and the graduated bath was used, reducing the temperature to 99° , though it subsequently rose to 104.0° . A gradual fall followed and the fever passed away about November 5th, or the forty-sixth day from its commencement. Neither purge nor change of diet accounted for this severe relapse following partial subsidence of fever.

6. J. B. S—, æt. 19, male, waiter, admitted to Charity Ward, under Dr. Bristowe, 15th October, 1877.

Ill six days before. Eruption on admission, lasting ten days. Diarrhœa for five days after admission. Spleen enlarged and tender. Temperature high, reaching 105.5° on third day of sojourn, ninth of fever, and 106.2° the next morning, with a pulse of 150 to the minute. Three baths were given on that day, and one on the next, after which the temperature came down, and became normal in the third week of sojourn (fourth of disease). Then in the fourth week, beginning on the 7th November, the temperature rebounded by successive steps to 105.1° on the 9th November and remained high during the next sixteen or seventeen days. Eruption appeared on the twenty-seventh day of the relapse, and lasted fourteen days. The diarrhœa of the relapse was not severe, but the abdominal pain and tenderness were more marked than in the primary attack. Relapse not accounted for by diet or treatment.

7. J. P—, æt. 21, male, labourer, admitted to Charity Ward, under Dr. Ord, 16th October, 1877.

Ill seven days. Eruption present on admission, but not next day. Temperature persistent at 104° of evening, with little remission in first week. Splenic enlargement, abdominal tenderness (right iliac fossa), with gurgling. In relation to this the surface temperature of the abdomen was compared in the two iliac fossæ. The temperature on the right side rose in five minutes to 98° , while on the left it rose to that height only in fifteen minutes. Ultimately the same temperature of 98° was

obtained on both sides, the axillary temperature being at the time $103\cdot4^{\circ}$. No diarrhœa.

In the second week (third of fever) the temperature fell, but near the end of third week (fourth of fever) it rose till on the 7th November it reached $105\cdot2^{\circ}$. Spots appeared on the 4th November, the day of the new rise, in association with rigors, and again on the 6th. The abdominal distress became more severe, but there was still no diarrhœa. The distension of the abdomen was treated by turpentine stupes, the more intense subsequent pain and tenderness of the full relapse by the icc-bag.

The relapse was not accounted for by treatment or diet.

8. C. C—, æt. 15, male, baker, admitted to Arthur Ward on the 24th October, 1877, under Dr. Murchison.

Ill fourteen days before admission. Eruption evidently just ending, a few spots being found on the day of admission and two days following. No diarrhœa; abdominal symptoms mild, spleen not enlarged. The temperature was not high in the first week (third of disease); average $99\cdot1^{\circ}$ in evening, with average remissions of $1\cdot7^{\circ}$. In the next week it was subnormal, $97\cdot6^{\circ}$, both morning and evening. In the fourth week (or sixth of disease) the fever returned, and on the 9th the highest temperature, $102\cdot9^{\circ}$ was reached. This occurred after the administration of castor oil and was attended by perspiration, dry tongue, and diarrhœa, but no spots. Subsidence took place in the fifth week (seventh of disease), and in the two weeks following the temperature was subnormal, becoming normal in the seventh week (ninth of disease). In this protracted though never severe case the relapse was attended with more fever than was observed in the first attack, but as the patient had been ill fourteen days before admission the acme had of course passed when he came under observation. The relapse was characteristic in all points save the eruption, and it coincided with the use of castor oil to remove constipation, the temperature rising with the action of the bowels.

9. J. J. H—, æt. 8, male, schoolboy, admitted to Job Ward, under Dr. Stone, 31st October, 1877.

Ill ten days before. Diarrhœa, but no eruption, at admission. Relapse on 22nd November (thirty-second day of illness), following the use of enema. Notes partly lost.

10. H. J—, æt. 11, male, schoolboy, admitted to Arthur Ward, under Dr. Murehison, October 22nd, 1877.

Ill three days before. There was no eruption at any time, and the bowels were mostly confined; the abdominal pain, tenderness, and tension, were considerable, and the splenic enlargement marked.

After a fall at the end of the second week of the fever the temperature rose in the third week, and became very high— $105\cdot4^{\circ}$ —in the fourth, after which a very gradual decline took place, and it was not till the ninth week that convalescence could be said to have commenced. This case was, like No. 5, marked by a sort of abortion of the primary fever at the end of the second or beginning of the third week, and by a subsequent relapse of great severity. No conditions external to the patient existed to explain this.

11. E. M—, æt. 52, female, housekeeper, admitted to Alice Ward, under Dr. Ord, 16th October, 1877.

Ill seven days before admission. Eruption present at admission and on two days subsequent. The beginning of the attack was severe. Diarrhœa, vomiting, and delirium. The abdomen was distended and tender. Enlargement of the spleen was not detected, but as the patient was fat and the bowel distended there is no proof that enlargement did not exist.

During the first two weeks of sojourn (second and third weeks of disease) the temperature was high. On the second day large hæmorrhage occurred, with a sudden fall of $8\cdot4^{\circ}$, namely, from $102\cdot2^{\circ}$ to $93\cdot8^{\circ}$. Again on the seventh day with a less decided fall. The course of the temperature, otherwise, was of the typhoid type, and gradually fell till in the sixth week of fever it was nearly normal. In the seventh week a relapse occurred, with increase of diarrhœa and severe and persistent vomiting, but no eruption. During the next six weeks the temperature fell several times to normal, but rose again for days together, always with increase of diarrhœa. It was evident that the extent of ulceration in the intestines was very large, that the patient's power of recovery was feeble, and that healing was slow and subject to frequent arrest or reversal.

The ice-bag was used freely in this case. The diarrhœa was treated with opium and gallic acid, the vomiting with several

remedies, of which small and frequently repeated doses of nuxvomica and ipecacuanha were the most successful. Constipation occurred between the attack and relapse, and was treated by Enema Olei Olivæ. The relapse occurred in connection with renewal of action after one of the encmata.

12. C. K—, æt. 25, male, labourer, admitted to Job Ward, under Dr. Bristowe, 17th December, 1877.

Ill seven days before. The temperature was high in the first week (second of disease) and was low during the next fortnight. The fall was not, however, accompanied by disappearance of the characteristic symptoms, and in the fifth week (sixth of disease) rose suddenly to $104\cdot6^{\circ}$, and remained high for three days. Diarrhœa accompanied this rise, and on its being checked by opium the temperature fell again. The relapse was short but of great intensity, the rate of the pulse being noted to have been 140 in the minute on the second day. The relapse is not explained by treatment or diet.

13. L. H—, æt. 40, widow, admitted to Mary Ward, under Dr. Murchison, 16th October, 1877.

The record of this case is most accurately kept and of great length, the case having been both complicated and protracted.

Ill fourteen days before admission. Eruption on the day of admission and two days following. Diarrhœa of moderate severity during first week (third of disease); splenic dulness increased; temperature somewhat high; $104\cdot2^{\circ}$ at admission; average of week—evening $103\cdot6^{\circ}$, morning $101\cdot9^{\circ}$. Hæmorrhage from the intestines, foretold by a rapid fall, and followed by a rise to $104\cdot4^{\circ}$, occurred in the second week (fourth of disease). The bleeding was treated by opium, turpentine, and tannic acid, with the use of the ice-bag. The temperature continued high in the evening during the fifth week of the disease, but the morning remissions were very large (from $103\cdot3^{\circ}$ on the 30th to 94° on 31st), and the symptoms of abdominal abscess and peritonitis appeared. Rigors, which began with the fall on the 31st, went on till the 9th November, when another great remission occurred (104° to $98\cdot8^{\circ}$); they were then absent for a few days, but recurred on the 18th (seventh week) and 22nd (eighth week), with rise of temperature to $104\cdot3^{\circ}$.

On the 23rd the morning temperature was $104\cdot0^{\circ}$, the even-

ing 102.0° , and on the next day normal limits were resumed. Rigors again occurred on the 29th November and 2nd December, but in the tenth week the enteric fever seemed to be at an end. Pericarditis and inflammation in the groin and thigh came, however, as sequelæ, and the patient could not be regarded as convalescent till the seventeenth week.

It can hardly be said, indeed, that this case was one of relapse, but the protraction and the variety of complications and fluctuations of temperature make it worthy to be recorded at even so short a length as is here possible. The abdominal abscess which is presumed to have existed did not open externally, and at the time of discharge of the patient there appears to have been neither tumour nor tenderness.

14. E. S—, æt. 20, female, single, servant, admitted to Lydia Ward, under Dr. Stone, 23rd January, 1878.

Ill three weeks before. No rash on admission. No diarrhœa. Splenic enlargement. Much delirium. In the second (fifth) week the fever and its symptoms abated, but in the sixth week (February 9th) a rigor introduced a rise of temperature to 101.8° , and by the 11th the evening temperature was 104.2° . There was no diarrhœa, but an abundant eruption of spots began on the 18th February (ninth day of relapse) and lasted seven days. The relapse was long as well as severe, normal temperature not being reached till the ninth week. A sudden fall from 102.6° one evening to 99.8° the next marked the inset of convalescence. The relapse began thirty-six hours after the commencement of bread diet, but was not connected with the use of aperients.

15. L. B—, æt. 28, female, dressmaker, admitted to Alice Ward, under Dr. Ord, 19th February, 1878.

Ill eight days before. No eruption on admission. Diarrhœa marked, but not severe, lasting thirteen days after admission; spleen enlarged, abdomen distended, and right iliac fossa very tender. Mitigation of all symptoms with reduction of heat in second week of sojourn (third of illness). Severe relapse beginning on March 2nd; temperature of 105° on March 5th and 6th; eruption on 8th (sixth of relapse). Constipation till 14th March (twelfth of relapse), when diarrhœa and intense abdominal pain set in, with a fall of temperature from 105.1° p.m. to 99° next morning, giving rise to fears of perforation or

peritonitis. The ice-bag was applied and opium freely administered. This treatment was used for several days, during which the diarrhœa continued in a moderate amount, but the rest of the symptoms gave way. By the sixth week the temperature was normal; but in the seventh, on the stoppage of the opium, the diarrhœa returned with severity, and another relapse with a typical eruption followed. This relapse, as read on the chart, took exactly the course of a typical primary attack. The temperature rose by successive steps during four days, remained high for three days with small remissions, still high with larger remissions for four days more, and then fell, still with large remissions. A typical eruption appeared on the eighth day and lasted ten days. The case was treated like a primary attack, with free use of opium and stimulants to help the enfeebled patient in her third struggle. She ultimately made a complete recovery. The second relapse followed, but not immediately, the introduction of cereal food into her dietary.

PART II.—USE OF THE GRADUATED BATH.

Abstracts of thirteen Cases of Treatment by Graduated Baths. (With Charts.)

CASE 1. *Enteric fever; mitral disease; high temperature; baths; death on twenty-eighth day.*—J. G—, æt. 36, potato buyer; admitted into Arthur Ward, under Dr. Stone, 31st July, 1877.

Ill two weeks before admission. At admission enteric spots; bowels confined; no great abdominal tenderness. Heart hypertrophied; double mitral murmur; dulness and tubular respiration at the apex of the right lung. Temperature ranging at about 105°, by the 9th August, when the first bath was given.

	Temp. before.	Temp. after.	Temp. of bath.
1st bath, Aug. 9th, 5 p.m. ...	103·2°	95·0°	96° cooled to 76° in 25 min.
2nd „ „ 11th, 7 p.m. ...	104·2	96·2	95 „ 71 in 30 „
3rd „ „ 12th, 5.40 p.m. ...	104·2	94·5	96 „ 70 in 25 „
4th „ „ 13th, 12.30 p.m. ...	Not stated.	...	96 „ 70 in 25 „

The highest temperature reached was 105.3° on the 12th ; the highest pulse 160 on the evening of the 11th before the bath. After the bath on the 12th the tongue, which had been dry and brown, became moist, and the lips, previously covered with sordes, were cleaned ; but on the 13th, with renewed rise of temperature, the tongue became brown again. The bath on each occasion was given while the temperature was rising, and though the water was not in any instance cooled below 70° , the temperature of the body was reduced on one occasion by nearly ten degrees and to as low a limit as 94.5° . The fact that the baths were used in the case of a patient suffering from mitral disease is important. The heart affection does not seem to have interfered with the immediate effects of the baths, but how much it may have had to do with the ultimate failure of the treatment cannot be estimated. The post-mortem appearances were those of typhoid fever without perforation, and of old-standing mitral disease. See Chart I.

CASE 2. *Enteric fever ; high temperature ; phlebitis ; baths ; recovery.*—L. W—, æt. 19, female, at home, admitted into Mary Ward, under Dr. Stone, 24th August, 1877.

Taken ill about August 17th. Fever lasted thirty-eight days. Highest evening temperature 105.6° on the eighteenth day. In the early part of the illness there were no serious local affections or complications, but the temperature rose in the third week to 104.0° and upwards.

The first bath was given at 10.45 p.m. on the 1st September (fifteenth day), when the temperature was at 104.0° and rising. The water was reduced from 90° to 83° in twenty minutes, and the temperature fell from 104.0° to 99° . Four hours later the temperature had risen to 103.3° . On the afternoon of the 2nd 104.2° was reached, 102.8° was registered in the morning of the 3rd, and in the afternoon at 3.30 the temperature was 104.2° . At 8 p.m., with a temperature of 103.6° , a bath at 100° was given, and was cooled during twenty minutes to 8.30° . On removal from the bath the patient's heat was still 101.6° , and it rose to 104° by 11 p.m.

Five more baths were given, the next that evening.

		Temp. before.	Temp. after.	Bath.
3rd bath,	Sept. 3,	11.35 p.m., 104·8°	... 99·5°	... 90°—78° in 30 min.
4th	„	4, 12.30 day, 103·6	... 101·4	... 90—70 in 30 „
5th	„	4, 7.30 p.m., 104·8	... 101·0	... 83—71 in 28 „
6th	„	4, 11.30 p.m., 105·0	... 99·8	... 82—71 in 28 „
7th	„	5, 6.40 p.m., 105·0	... 100·4	... 83—76 in 20 „

It will be seen that the constant tendency of the temperature to rise on the 4th September was controlled by as many as three graduated baths. The baths besides lowering the heat produced much comfort, and the patient passed much better nights after them, expressing herself as much soothed.

On the 7th, the temperature still ranging high, cold sponging was resorted to, and was used in all twelve times between the 7th and 11th inclusive, with an average reduction of 1° Fahr. on each application, though in two cases there was a fractional rise. This carried the patient on to the twenty-fifth day of the illness. After the 11th the temperature fell with extensive daily remissions to its natural range, which was reached about the 24th. There was an exceptional rise, however, on the 15th to 105·2°. Sponging effected a reduction of only 0·2°. On the following morning 99·2° was registered. This great variation of 6·0° Fahr. did not appear to be connected with any local mischief.

This case was a most protracted one. The heat was great from the first, and though there arose no local complications of importance, save phlebitis in the right leg, the case was full of danger through the high temperature.

The patient ultimately made a good recovery.

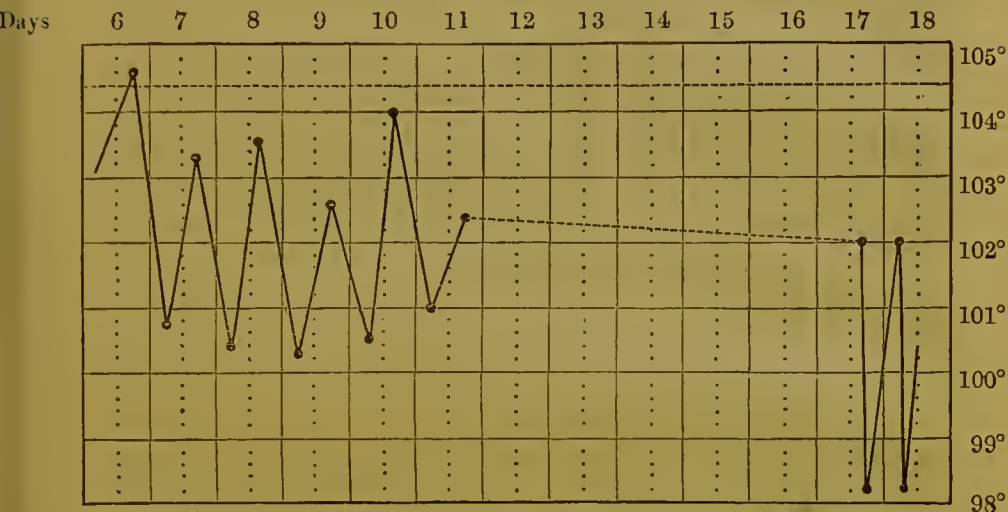
CASE 3. Enteric fever; high temperature; bath; relapse on thirty-first day; recovery.—A. W—, æt. 20, female, married, admitted to Alice Ward, under Dr. Ord, 18th September, 1877.

Attacked September 9th. Fever, without complications, running high on September 20th, 105·6°.

On that evening at 9.30 the patient was placed in a bath at 100°. During thirty-five minutes the bath was cooled to 76°, and at the end the temperature of the patient, which had been 105·5° in axilla, fell to 102° in mouth.

Two days later the temperature having risen to 105·8° the bath was repeated. The reduction was to 100·8°, and a rise to 103·8° soon followed. The bath was not required again.

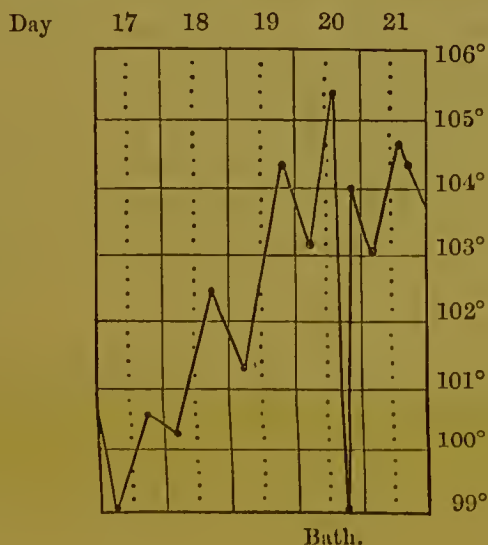
notes of the days immediately following are lost, but a relapse occurred on the 9th October and lasted till the 2nd November,



2 Baths.

the patient being ultimately discharged well on the 20th November.

CASE 7. *Enteric fever; high temperature; baths; recovery.*—W. D—, æt. 15, male, printer; admitted to Charity Ward, under Dr. Bristowe, 4th October, 1877. Attacked September 20th. Eruption October 8th; no complication. Primary attack subsided about 16th October; relapse on 19th; rise of temperature to 105.0° on 20th.



Bath, October 20th, 5.20 p.m., 100° to 84° in 30 min. Reduction of patient's temperature from 105.0° to 99.0° . Return to 104.3° same night, with subsequent gradual lysis.

CASE 8. *Enteric fever; pneumonia; high temperature; baths; subsequent relapse; recovery.*—J. B. S—, æt. 19, male, waiter; admitted to Charity Ward, under Dr. Bristowe, 15th October, 1877. Commencement of illness probably on October 9th. Eruption on admission. End of primary fever November 5th.

On October 18th, the temperature rose to 105.0° .

1st bath, Oct. 18,	1.30 a.m.,	87° — 68° in 26 min.,	fall of temp. from 105.0 — 98.4°
2nd „ „	18, 8.12 a.m.,	85 — 66 in 23 „ „	105.0 — 95.0
3rd „ „	18, 10.26 p.m.,	95 — 70 in 15 „ „	104.8 — 97.0
4th „ „	19, 5.15 a.m.,	88 — 68 in 15 „ „	105.5 — 96.2

After this, although the temperature sprang up again to 104.4° , it gradually yielded, and from the 27th October to the 7th November was within normal limits. Then the relapse occurred and lasted eighteen days, with a highest temperature of 105.1° ; and a new eruption on the 13th November, lasting thirteen days. No baths were used in the relapse.

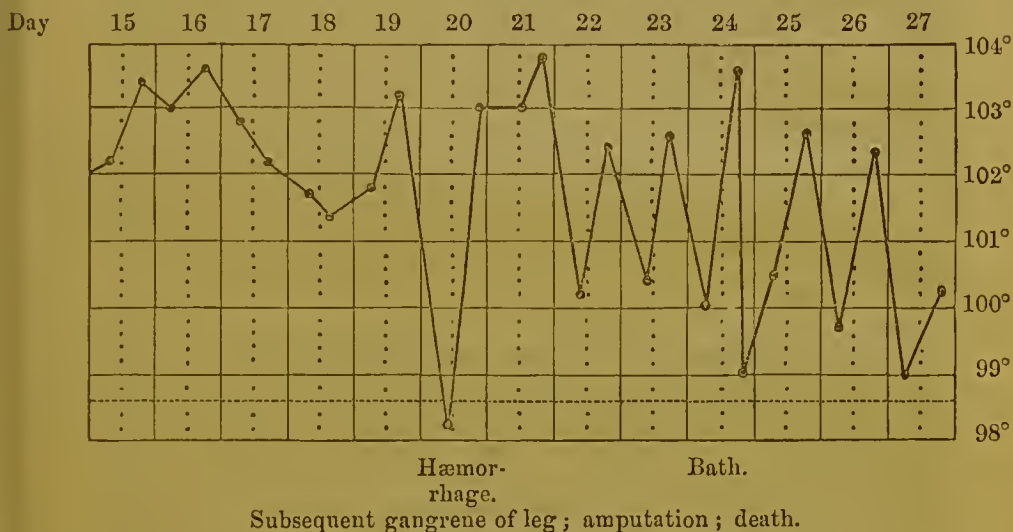
CASE 9. *Enteric fever; peritonitis; pneumonia; high temperature; baths; death.*—C. M—, æt. 19, housekeeper, male; admitted to Charity Ward, under Dr. Bristowe, October 24th, 1877. Attacked October 19th. Eruption October 28th. High temperature began on 25th (sixth day).

1st bath, Oct. 25, noon	... 96° to 64° in 30 min. ...	Patient 103° to 98°
2nd „ „ 25, 5 p.m.	... 95 to 66 in 25 „ ...	„ 104.8 to 98.4
3rd „ „ 25, 10.10 p.m.	... 96 to 65 in 26 „ ...	„ 105 to 98.4
4th „ „ 26, 4.55 p.m.	... 98 to 67 in 30 „ ...	„ 105.5 to 98.4
5th „ „ 26, 11.45 p.m.	... 98 to 66 in 30 „ ...	„ 105.5 to 99
6th „ „ 27, 12.45 p.m.	... 96 to 67 in 32 „ ...	„ 105 to 99
7th „ „ 28, 4.10 p.m.	... 98 to 66 in 30 „ ...	„ 104.7 to 99.5
8th „ „ 29, 6 p.m.	... 96 to 65 in 30 „ ...	„ 105.3 to 99.5
9th „ „ 29, 11.50 p.m.	... 96 to 65 in 30 „ ...	„ 105 to 98
10th „ „ 30, 12.40 a.m.	... 96 to 66 in 30 „ ...	„ 105 to 99

The bath temperatures of this patient were taken in the mouth, and the patient appeared to be more comfortable after each bath. There was hardly any delirium, which circumstance, as Mr. Taylor suggests, may probably be due to the baths. Death on November 3rd, or fifteenth day of fever.

Post-mortem report.—Enteric ulcer of small intestine ; pneumonia ; collapse of lung.

CASE 10. *Enteric fever ; hæmorrhage from bowels ; high temperature ; baths ; gangrene of foot ; amputation ; death.*—C. C—, æt. 34, male, labourer ; admitted to Arthur Ward, under Dr. Murchison, 23rd July, 1877. Attacked July 16th.



Eruption copious on admission. A fresh crop beginning on August 2nd and lasting ten days, indicating somewhat abortive primary attack with severe relapse.

The graduated bath was used on the 9th August, at 9.35 p.m. (96° to 77° in 25 min.). Patient 103.7° to 99° . The temperature after this gradually subsided, but on the 16th August, sharp hæmorrhage occurred ; and on the 20th August, gangrene of the left foot began. Amputation was subsequently performed, but the patient died on November 7th.

Post-mortem.—"Enteric fever ; gangrene of foot ; amputation ; pyæmia."

CASE 11. *Enteric fever, abortive one week ; relapse ; high temperature ; baths ; recovery.*—H. J—, æt. 11, male, school ; admitted to Arthur Ward, under Dr. Murchison, 22nd October, 1877.

Attacked October 9th. No eruption. The temperature in

the first week averaged in evenings $101\cdot6^{\circ}$, and fell in the second to $98\cdot3^{\circ}$. In the third week the evening average was $100\cdot2^{\circ}$, in the fourth $104\cdot8^{\circ}$. In this week the baths were used.

1st bath Nov. 11, 7.30 p.m. ...	100° to 75°	... Patient	$104\cdot8^{\circ}$ to $98\cdot5^{\circ}$
2nd " " 12, 12.15 a.m. ...	100 to 70	... "	105 to $97\cdot8$
3rd " " 12, 4.15 a.m. ...	100 to 73	... "	105 to $97\cdot9$
4th " " 13, 6 p.m. ...	100 to 71 in 20 min.	... "	105 to 98
5th " " 14, 5.30 p.m. ...	100 to 70	... "	$104\cdot9$ to 97
6th " " 14, 7.30 p.m. ...	100 to 71	... "	105 to $98\cdot8$
7th " " 15, 11.30 a.m. ...	100 to 70	... "	105 to $97\cdot4$
8th " " 16, 6.35 p.m. ...	100 to 70	... "	$105\cdot3$ to $98\cdot5$

In the fifth week the temperature yielded, and a very long convalescence, with complications of periostitis of tibia and fibula, and bed-sores followed. The patient was not discharged till the 30th January, 1878, more than three months after admission.

CASE 12. *Acute rheumatism ; old mitral disease ; pericarditis ; high temperature ; baths ; recovery.*—S. S. A—, æt. 16, male, japanner ; admitted to Charity Ward, under Dr. Bristowe, 23rd September, 1876. Attacked with acute rheumatism on September 20th. Severe inflammation of several joints, with profuse perspiration. Systolic mitral murmur. Pericarditis. On 27th excessive sudaminal eruption. On 28th rise of temperature to $106\cdot4^{\circ}$.

Bath 12.30 mid-day. Had a graduated bath from 90° to 75° ; duration not stated, but believed to have been thirty minutes. Temperature of patient reduced to $96\cdot6^{\circ}$; rose at night to $104\cdot1^{\circ}$, but afterwards subsided, and three days after was normal. Patient discharged well on 13th October, twenty days after admission, and fifteen after bath.

It is to be noted that from the 26th to the 28th the patient was taking salicylate of soda, in doses of thirty grains, every two hours. This was discontinued on the 28th when, to meet the rapid rise of temperature, the bath was used.

CASE 13. *Acute rheumatism ; endocarditis ; high temperature ; baths ; recovery.*—E. C—, æt. 25, female, single servant ; admitted to Alice Ward, May 27th, 1877.

Attacked with acute rheumatism on the 22nd May. Severe affection of joints ; profuse perspiration. Endocardial mitral

murmur; no pericarditis. By the 31st the temperature was 103.2° , and salicylate of soda, in doses of twenty grains every four hours, was ordered. The temperature not yielding, the dose was increased to thirty grains every three hours on the 1st June. On the 2nd June the salicylate was stopped after eight doses, the patient showing signs of intolerance of it (feelings of "silliness," "noises in head," "feeling queer," "almost rambling," &c). The temperature was now 105.0° .

On the 4th, the temperature having risen to 106.3° , a bath was administered at 95° , gradually reduced to 70° , during half an hour. After the bath the patient's temperature was 96.5° . Great ease followed, all pain disappeared, and the temperature did not exceed 102.2° the next day, falling well below 100° on the 6th.

On the 19th a return of rheumatic inflammation in the right knee and both ankles was followed by a rise of the temperature to 102° . This yielded rapidly to twenty grain doses of salicylate of soda, given every two hours, and the patient gradually recovered, going out well on the 13th July, 1877.

Remarks on the use of the Graduated Bath in hyperpyrexia.

The term "graduated bath" is here used to denote a bath in which the temperature of the water at the time of immersion is at some point between 90° and 100° Fahrenheit, and is gradually lowered by from 25° to 30° during an immersion of half-an-hour's duration. The term therefore does not include the cold bath of 55° or under which is sometimes used, but to which no recourse has been had, at least of late, in this hospital.

Attention may first be directed to the two cases of acute rheumatism in which the bath was used. They were cases of great severity, with extensive and very sharp inflammation of joints, and with endocarditis. Both cases were treated at first with salicylate of soda.

In the first, a woman of 35 years, the salicylate was begun in doses of twenty grains every four hours. At the end of twenty-four hours, after six doses had been given, the dose was raised to thirty grains, the frequency increased to every three hours. While under this treatment the patient became more

feverish, a profuse eruption of sudamina occurred, and noises in the head, and feelings of giddiness were complained of. At the eighth dose the salicylate was stopped, the temperature being 106.0° . The bath was then used, as indicated on the chart, and the temperature at the end of the half hour's immersion, when the bath was at 70° , had fallen to 96.5° , a difference of 9.5° Fahr. This crushed the fever for the time and for many days, though a subsequent rise of temperature occurred and was subdued by the salicylate. It may be noted that the urine did not become albuminous in this case.

In the other case, the salicylate was given from the first in doses of thirty grains every two hours, and was stopped at the seventeenth dose. No nervous symptoms are recorded; but sudamina were abundant and resembled croton oil rash, while the urine was albuminous.

Recourse was had to the bath because the temperature had risen briskly during the administration of the salicylate, and after the seventeenth dose had reached the dangerous figure of 106.4° . The bath was graduated from 90° to 64° during half-an-hour, and at the end the patient's temperature was 96.6° , a fall of nearly 10° Fahr. The fever was completely subdued, normal temperature being permanently resumed on the fourth day after the bath; the patient was allowed to get up on the twelfth day, and was presented on the fifteenth day.

The fact of the complete failure of the salicylate though given in full and rapidly repeated doses is the first point of interest in these cases. If the doses be counted up, 360 grains of salicylate will be found to have been given in forty-eight hours in the first case, and 510 grains in thirty-six hours in the second. The toxic influence of the drug was well declared, by noises in the head and giddiness in the one, by albuminuria in the other. Nevertheless the temperature continued to rise in both instances to 106° or upwards. The effect of the bath was in both to produce an immediate fall of between 9° and 10° Fahr., and a complete cessation of pain, restlessness, and other symptoms attendant on fever. And the effect was also lasting, the rebound not reaching in either case within 3° of the acme, and being followed by rapid defervescence.

If experience is worth anything in prognosis, the use of the bath, in these two cases, plainly saved life. Useful as the

salicylate of soda may be in acute rheumatism generally, it must be admitted that the foregoing instances demonstrate its inadequacy in certain cases of high fever, and shew that we have in the bath a remedy capable of completely controlling the hyper-pyrexia under these circumstances. The way in which the temperature ran up during the use of the salicylate raises, in fact, a doubt as to whether the salicylate may not have aggravated matters. It will hardly be contended by anyone that the drug had not its full chance, the toxic effects having been well developed. Certainly there is no reason to think that it should have been pushed further, as has been done in some instances on record. My own opinion is that this would have resulted in further poisoning with very little chance of victory over the disease; and that the patients would have died of salicylic acid instead of acute rheumatism.

There follows another consideration of great interest. May the singularly decisive action of the bath have been favoured by the previous full use of salicylic acid? Is the power of checking hyperpyrexia dependent on the same or on different conditions in the two treatments?

In acute rheumatism the existence of two elements at least must be admitted, one local, the other constitutional. As regards the constitutional element several assertions may safely be made.

1. Certain persons are more liable to have acute rheumatism than others.

2. Certain family groups of persons are more liable than other family groups.

3. The persons and families who are thus more liable than the average to acute rheumatism tend to develop hyperpyrexia more than the average. They also tend more to contract, and with severity, other fevers, in particular scarlatina diphtheria and enteric fever.

A considerable experience and analysis of family histories justifies me in making the above assertions. They mean that in certain persons the whole system is readily set in flame by provocatives which would be unnoticed by the system of others that there is greater sensitiveness, greater chemical activity, greater readiness to disintegration. The whole subject of such family and individual febrile diathesis might be followed out

But it would take us at present too far from our proper subject.

The beginning of attacks of acute rheumatism, however, is frequently a local phenomenon. One joint, or perhaps two symmetrical joints, are often inflamed several hours in advance of the general febrility. Such joints are often those which, from the nature of the patient's employment, have more heavy work regularly thrown upon them than other joints, or have been exposed to recent violent strain. In the absence of the particular diathetic state, some aching, some pain, some stiffness, would be all that would be produced. But in persons prone by stock-inheritance to the acute rheumatic process, or brought into ill health and weak resisting state by unwholesome conditions of life, or more acutely inflammable through the effects of some chill, shock, or systemic strain, the joint sharing in the general weakness—in the general tendency to degeneration—takes on the rheumatic inflammation instead of the simple one, and the system is set on fire from this focus. In the fever which follows, the dangers, and consequently the treatment, must vary according as the series of local inflammations is wide or of grave character, and according as the general febrile action is intense. For, though there is generally high fever, with much joint affection, this rule is not always obeyed, and very frequently the general fever runs to a height altogether above the proportion which it should bear to the local inflammation.

Like blisters placed near joints, or between joints and the trunk, salicylic acid, in all probability, exercises a distinct influence in the repression of the local actions of the disease. It appears to have power to check the inflammatory process, or the disintegrations upon which inflammation depends at the point or points from which the general conflagration starts. The rapid disappearance of pain, and the mitigation of the inflammation of joints, which often follows the administration of one or two doses of salicylic acid, or its salts, afford grounds for such an opinion. These effects are often illustrated in the relapses frequently seen in the course of rheumatic fever, when the joint inflammation comes under notice before the systemic fever is developed, and is easily subdued by a few doses of the remedy before the general temperature is seriously

raised. In our present knowledge of the effects of remedies it would not be fair to attribute to salicylic acid merely local influence. The remedy has, to all appearance, considerable power of reducing the temperature of the whole body ; but how much by checking local inflammation, and how much by a general influence, I do not pretend to estimate.

The graduated bath, again, has probably a double remedial action, general and local. The nature of the remedy would at first sight suggest that it would diminish the bodily heat in a direct fashion, by simple ablation of excess. The way in which the bath acts, however, indicates that it has a wider function than this. It exercises, in the first instance, a remarkable sedative influence on the nervous system, and in the second place it diminishes the local pain and inflammation. If the chief effect of the bath were to take away so much heat, the use of lower temperatures than those quoted would be required. But if it is evident that we can effect our total purpose of lowering temperature and arresting morbid processes without producing shock, we may be satisfied with the application of the remedy in the milder form. The shock of plunging a fever patient into a bath at 40°, or less, has been shown by experience to be considerable, and even dangerous. If, therefore, we can satisfy ourselves that the use of the graduated bath involves several modes of action, besides the simple question of specific heat of the body, we shall be putting our practice on a safer as well as a wider basis.

In cases already quoted (*'St. Thos. Hosp. Rep.,' New Ser., vol vii, 1876*) I have given reason for believing that by reflex nervous influence the bath, as a soothing agent, controls internal and local inflammations. In particular, I have shown that severe bronchial catarrh, associated with high fever, has yielded as quickly as the temperature itself, and has yielded without returning. The same thing is seen in the effects of the bath upon the joints in the two cases now described. Again, on all occasions the bath is found to have calmed the patient. Under its use the excitement, restlessness, and distress, of fever abate, or so completely remit that tranquil sleep is induced. Patients who have not slept for several days have sometimes fallen asleep before the bath was over. I have seen a bronchitic child fall so soundly asleep as not to be wakened by the process

of drying after the bath, so soundly as to make the bystanders a little anxious whether they were dealing with an unconsciousness deeper than sleep; and after two hours the child has wakened free from pain, dyspnœa, or cough.

This agrees with the known effect of the "cold pack" of hydropathy in procuring sleep.

The sedative effect of cold is, to my mind, therefore, the main agent in the whole process. But no doubt a considerable quantity of heat is actually abstracted from the body even by the graduated bath.

In so composite a structure as an animal body the estimation of specific heat is very difficult; but as I have recently made two observations upon the cooling of the human body in baths I venture to record them here. The observations are, perhaps, mainly useful in indicating the difficulties of the investigation, but they bring out at least one point of value.

The subject of experiment was the body of a man recently drowned. The body was somewhat thin, the height being 5 ft. 11 in., the weight 9 stone $2\frac{1}{2}$ lb. The apparent age was between fifty and sixty. Rigor mortis was marked. The temperature of the room in which the experiment was made was 60° Fahr.

The body was placed in a bath of water at 110° Fahr., and the water was maintained at this heat for three hours and a quarter.

Nine non-registering clinical thermometers, kindly lent to me by Mr. Hawksley, were now inserted into the body, through holes made by a trocar, at the following points:

1. In the tissues of the neck, two and a half inches deep.
2. Deltoid, two inches.
3. Heart.
4. Liver.
5. Spleen.
6. Thigh, as near centre of limb as possible.
7. Horizontally between skin and muscles of thigh.
8. Rectum.
9. Calf.

The insertion of the thermometers occupied some little time, and the first reading of temperatures was not made till fifteen minutes after the commencement of the operation. The readings then were:

Temp. of bath	.	.	109·0°.	
No. 1. Neck	.	.	97·9°.	
„ 2. Deltoid	.	.	104·4°.	The opening made was found afterwards to have been irregular, so as to allow of the entry of the water.
„ 3. Heart	.	below	90·0°.	
„ 4. Liver.	.	„	90·0°.	
„ 5. Spleen	.	„	90·0°.	
„ 6. Thigh, deep.	.	.	93·2°.	
„ 7. „ super.	.	.	100·2°.	
„ 8. Rectum	.	.	Could not be read.	
„ 9. Calf	.	.	106·6°.	Opening too free.

At 3.10 p.m., twenty-five minutes after the commencement of the insertion of the thermometers, the bath was again at 110°. It was thereafter cooled gradually as follows:

At 3.15 to 100°.
 At 3.20 to 95°.
 At 3.25 to 92°.
 At 3.35 to 80°.
 At 3.45 to 71°, or 39° reduction.

The water was then run off and the readings taken as follows:

1. Neck	.	.	.	.	94·8°.
2. Deltoid	.	.	.	.	95·0°.
3. Heart	.	.	.	.	90·3°.
4. Liver	.	.	.	under	90·0°.
5. Spleen	.	.	.	„	90·0°.
6. Thigh, deep	.	.	.	.	100·7°.
7. „ super.	.	.	.	under	90·0°.
8. ———					
9. Calf	.	.	.	.	101·6°.

The quantity of water in the bath was found to be ninety one gallons.

The experiment was renewed next day, when the rigor mortis was passing off and general decomposition was beginning. The temperature of the room was 56°, the temperature of the body 60° in the mouth. Immersion at 10 a.m.; temperature of bath 110°.

At 12.30 p.m. (two hours and a half later) readings were

taken of thermometers inserted at noon, care being taken to make small openings in the skin, and to see that the thermometers fitted them.

1. Neck	.	.	.	.	101·3°.
2. Deltoid	.	.	.	.	102·4°.
3. Heart	.	.	.	.	89·8°.
4. Liver	.	.	.	below	90·0°.
5. Spleen	.	.	.	.	94·0°.
6. Thigh, deep	.	.	.	.	95·8°.
7. „ superf.	.	.	.	.	100·4°.
8. ———					
9. Calf	.	.	.	.	102·8°.

At this moment a great flood occurred in South London, and the water entering the basement of the deadhouse in which the observations were in progress extinguished the fires by which the boilers were heated, so that, a sufficient supply of hot water not being available, the bath gradually declined in temperature.

The final observations were taken at 5.40, when, the bath being at 90·0°, it was arranged to take temperatures, to cool rapidly to 50° or thereabout, and to read again at the end of half an hour.

The long immersion had given time for the raising of the temperature in the interior of the body, and we should be able to see if half an hour's exposure to a temperature of 50° in water kept moving would affect the heat of the deeper parts.

Readings at 5.40 p.m. Temp. 90·0°.				At 6.15 p.m., after 30 min. immersion in water at 51·3; 91 galls. in movement.	
1. Neck	.	.	93·6°	...	under 90·0°.
2. Deltoid	.	.	92·7°	...	„ 90·0°.
3. Heart	.	.	92·6°	...	91·8°.
4. Liver	.	.	92·5°	...	Into bulb, bad fit.
5. Spleen	.	.	91·2°	...	Into bulb, good fit.
6. Right thigh, deep			94·4°	...	Ditto.
7. Left „ superf.			89·7°	...	Ditto.
8. ———					
9. Calf	.	.	93·3°	...	Ditto.

There is just one inference to be drawn from the above, that in the dead body, the interior parts are only slowly affected by changes in the temperature of the surface. It will be seen that from accident or want of experience some of the observations were vitiated. But some were free from obvious error,

and among them may be noted those of the thermometer plunged two and a half inches deep into the middle of the neck downwards and inwards behind the sterno-mastoid, and of that placed in the heart.

In the neck, at the end of two hours and a half of immersion in water at 110° , the temperature had reached only 97.8° , or 12.2° short. At the end of a graduated bath falling 39° in thirty minutes the temperature in the neck was 94.8° , a fall of only 3.0° , which it may be well to compare with the fall of the temperature in the living body by 10° in a bath reduced only by 30° or 25° in the same time.

Similarly with the heart. The thermometer was well introduced into its substance at the middle of septum ventriculorum. After three and a quarter hours' immersion in the bath at 110° , the temperature had not reached 90° , the lowest reading of the clinical thermometer used.

The next day, a thermometer having a lower range of indication being used, the temperature of the heart, after two and a half hours' immersion, was 89.8° . It appeared that the interior parts had all been gradually reached by the heat applied the day before, and were warmer than before the first observation was made. At the end of five hours and ten minutes, during which the bath had slowly cooled from 110° to 90° , the temperature of the heart had actually risen to 92.6° , a part of the heat already absorbed having travelled inwards. Lastly, although the body was immersed for thirty minutes in water nearly 39° lower than that in which it had stood at the end of the eight hours' cooking, the temperature of the heart was lowered only 0.8° .

In the other internal organs which agreed generally with the heart in the run of the temperatures during the warm baths, the fall in the cool bath was much more complete, but the fit of the thermometer having been found to be less accurate after the cooling than before, no importance can be attached to the observations. In fact, the whole observation is chiefly of value as a preliminary to further and wider inquiry, though it shows that the bath actually does draw a considerable quantity of heat from the superficial parts of the body. During life the constant interchange of temperature effected by the circulation of the blood would, of course, operate in cooling the interior

at the expense of the exterior, and equalizing the reduction of temperature throughout the body.

Having now devoted some attention to two ways in which the bath may act, namely, as a calming agent and as a purely physical one, I wish briefly to touch upon some other considerations. The rise of temperature in part and in system has been so far accepted as a fact without explanation being sought. Broadly, there are three ways in which the temperature of a body may be raised.

1. There may be an increased reception or generation of heat.
2. There may be retention of heat which is accustomed to be set free.
3. There may be a cessation of processes by which heat is used up.

As long as the heat of fever was supposed to be a simple product of combustion the action of febrifuges appeared to be a quenching of extra fire with a removal of surplus heat, the latter being effected best by the bath, the former by internal remedies.

It is well known that Traube disputed this simple explanation, and advanced the idea noted under head 2 that heat was unnaturally retained in the body, the contraction of vessels of the surface keeping the blood in the interior, and with it the heat, which could escape but slowly on account of the small conducting power of the tissues. This might cause rise of internal temperature if there were no increase of combustion, and would increase the effect of any increase of combustion in raising heat. Within the last few years, again, the proposition has been advanced that increased and diminished temperatures have no necessary connection with increased or diminished production of heat.¹ Such a proposition has a look of paradox about it. But the calculations which support it certainly carry much weight, and may well direct our attention to the economy of heat in the body. Traube's hypothesis may be taken as a solution in part, but only in part, of the paradox, since the skin itself is actually overheated in fever. May it be further possible that during the process of fever heat which should be

¹ See 'Reports of Medical Officer to the Privy Council,' &c., new ser., No. vi, 1875. "On the Process of Fever," by Dr. Burdon Sanderson, F.R.S.

used up in certain natural operations is not so used, and remains free to do mischief? Heat is often seen acting thus in the laboratory. If the water bath by which evaporation of matters at fixed temperatures is to be effected becomes at any time dry, the heat that should have been used up in turning the water into steam is suddenly thrown in excess upon our evaporating dish, and the matters which should have been safe at 212° degrees, or under, are burnt. It would be a help to the solution of the problem if we could show that heat is used up ("becomes latent") in the normal process of organisation, of building up or remodelling the colloids of the body. In the hatching of an egg we know that outside heat is required from the beginning to the end. This must imply that the very active transformations then taking place do not produce enough heat to keep themselves going, that they depend upon the introduction of heat from without. The same principle is illustrated also in the young and actively growing animal, which, even if its normal temperature be high, has to be "kept warm" and cherished.

If great activity of metamorphosis were by itself a cause of rise of temperature, the egg and the child ought to be hotter than the full grown animal, and to be independent of external warmth. When we find that they do not show any such wealth of heat we may infer that in some way heat is used up, either by evaporation or transformation.

Now, in the process of fever, while it is evident that there is a distinct increase of combustion, it is not, as we see, so evident that this at all corresponds with the increase of temperature. During the same process the normal metamorphoses are also hindered or at a standstill. It is therefore quite possible that heat which should have been used in these transformations is left free, is set loose to effect the transformation of the destructive kind which we call combustion. A supposition of this kind, involving the maintenance of a static condition in the colloids of the body, may be an explanation of the anorexia which is characteristic of all febrility—so characteristic that it is not thought worth explaining—and is consistent with the remarkable absence of the chlorides, particularly of the chloride of sodium, from the urine. Involving, again, a static condition of the molecules of colloids, this sup-

position is in harmony with the sense of tension or strain belonging to the febrile state. Supposing such a condition to exist, and exist throughout the body, it follows that it must be maintained by some persistent condition of the nervous system, in which, as it were by opening or closure of a circuit, certain actions of one kind are suspended, certain actions of another kind permitted. The ease and sleep which follow the bath may, upon this supposition, be supposed to be connected with a removal of this strain, and the resumption of the normal changes belonging to tissue-building.

The Bath in Enteric Fever.

The relatively small mortality of this epidemic has been already noted. I venture to claim the reduction as a result of the use of baths. Of the cases in which baths were used, several were clearly arrested in a fatal course. That the bath was not always successful was to be expected. The lesions of enteric fever are so often sufficient of themselves to kill that a remedy which deals chiefly with hyperpyrexia cannot be expected to be a panacea. So far, however, as the danger in any case is purely one of hyperpyrexia, the efficiency of the bath is manifest. The cases in which it succeeded were cases of such a kind; the cases in which it failed were fatal by reason of peritonitis, perforation, or great extent of intestinal glandular lesion with exhausting diarrhoea. Even in these cases the bath has appeared to protract the struggle, affording delay during which more favorable local states might be established. And it may be noted that another external application—the ice bag—has, alone or with the bath, been able to control violent peritoneal inflammation associated with symptoms almost certainly demonstrative of perforation.

A reference to the charts will demonstrate that the effect of the bath was less decisive in the cases of enteric fever than in those of acute rheumatism. The lowering of the temperature was not carried so far, being more often from 6° to 8°, although in one instance, a fall of 11° is recorded (John S—). The subsequent rise was also often rapid, involving generally a speedy repetition of the bath. In the case of John S— the

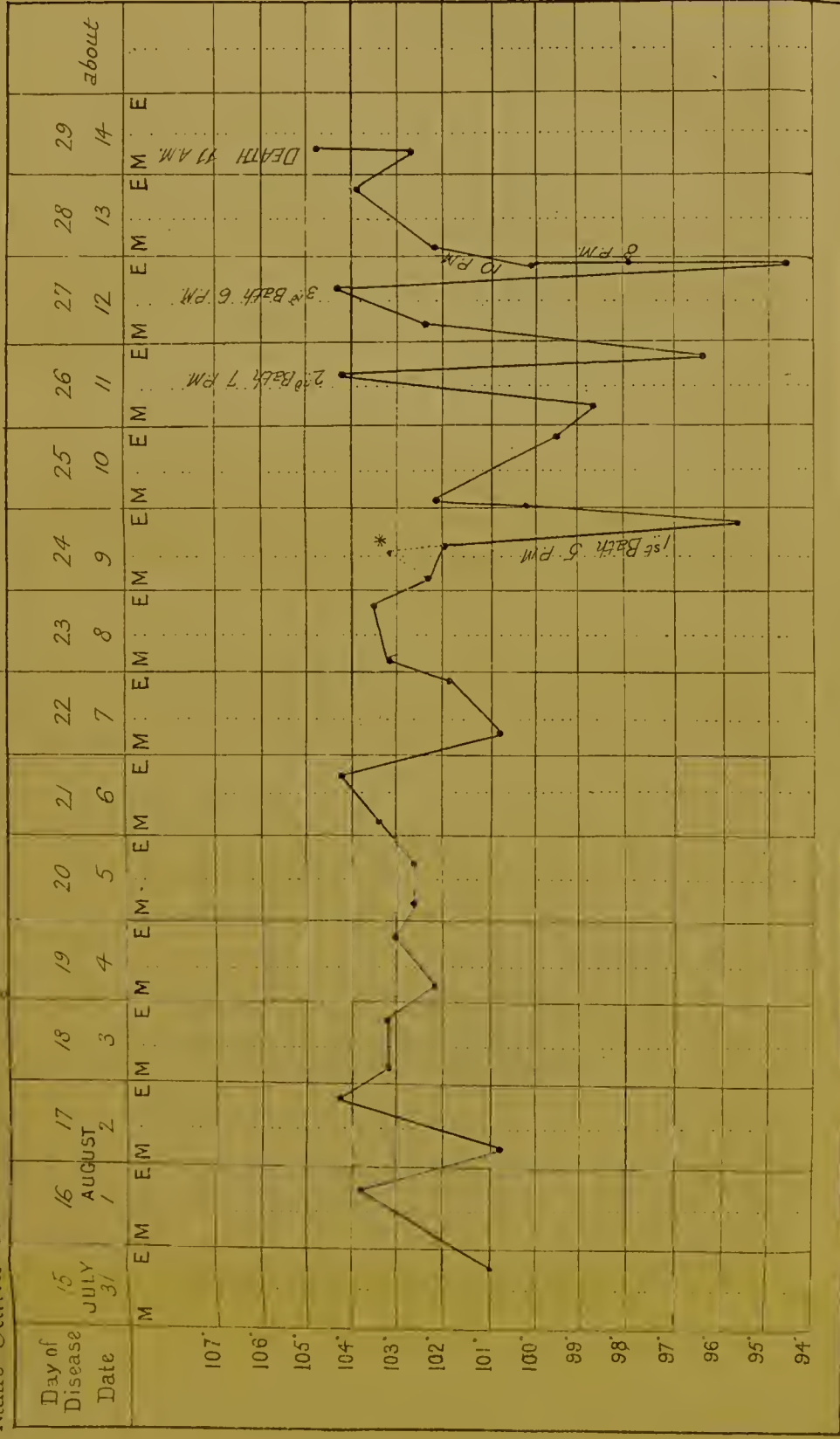
temperature rose within seven hours to a degree above that for which the first bath was given, and four baths were required within twenty-eight hours, the last finally subduing the ascent of fever and introducing a slow but unbroken recovery. In other cases the struggle was further prolonged. Henry J— was bathed eight times between the twenty-third and twenty-eighth days of the fever; and in the case of Louisa W—, while the fiercer heat of the second week was kept under by as many as seven baths, cold sponging was resorted to no less than thirteen times afterwards, the last time on the twentieth day, before the force of the fever could be regarded as broken.

The experience of the use of salicylate of soda in enteric fever agrees with that of the bath in indicating that the more serious and persistent nature of the local lesion reduces the curative effect of the remedy. But both remedies appear to mitigate the intensity of the local process, to weaken its reaction on the system, and to diminish the response of the system to the invitations to excitement proceeding from the part. Here, however, as in acute rheumatism, the bath is the more energetic remedy of the two, and the safer. No evil results of any kind can be traced to its use, the only objections to it resting on grounds of trouble and exposure, such as ordinary care and nursing power ought to exclude. The cases presented in abstract appear to me so satisfactory as to justify, or perhaps even to demand, the use of the bath in all cases of hyperpyrexia in enteric fever where the moving of the patient is not contra-indicated by peritoneal complication or perforation. Even then the cool pack or cold sponging are valuable substitutes. The rule at present adopted with reference to the bath is that it should be used, with the above necessary exceptions, whenever in enteric fever the temperature having reached 105° is still rising, particularly if the rise be before or after the usual evening hour. As I have claimed before, the practice, though not uniformly successful, has not in any instance done any known harm, and has, in all probability, averted death in several instances. Accordingly, notwithstanding some difficulties arising in the carrying out of the process of bathing, I propose to adhere to this rule in all cases of enteric fever coming under my care.

I cannot conclude this paper without expressing my obli-

gations to Mr. Walter Tyrrell, recently my house physician, and to my friend Mr. Seymour Taylor, who has helped me greatly in the collection and analysis of the cases, and in the experiments recorded.

Name James S. Age 36 Disease Enteric Fever.



Case 1.

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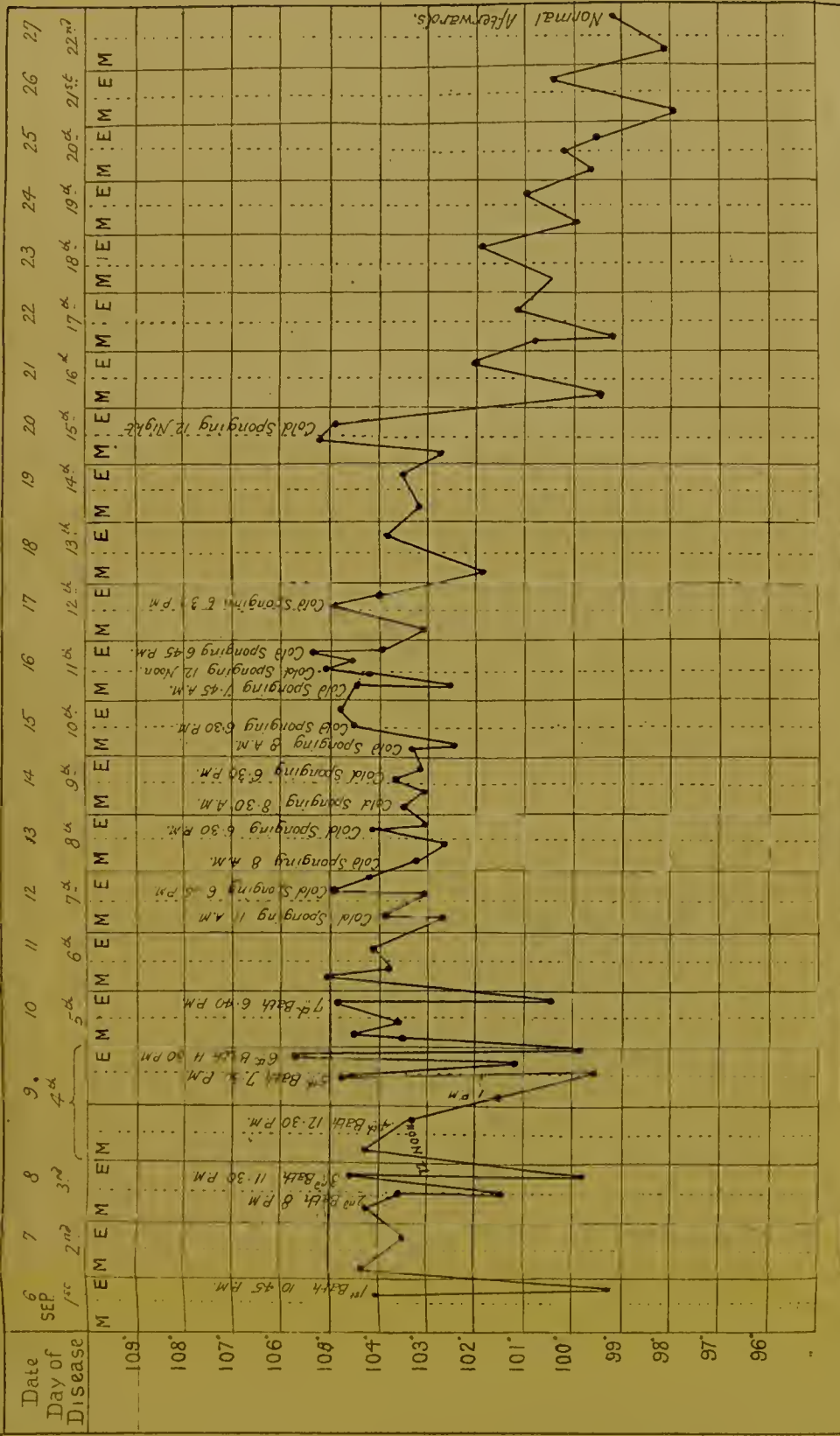
* a doubtful observation.

Plate I.

Name Louisa W.

Age 19

Disease Enteric Fever.



Case 2.

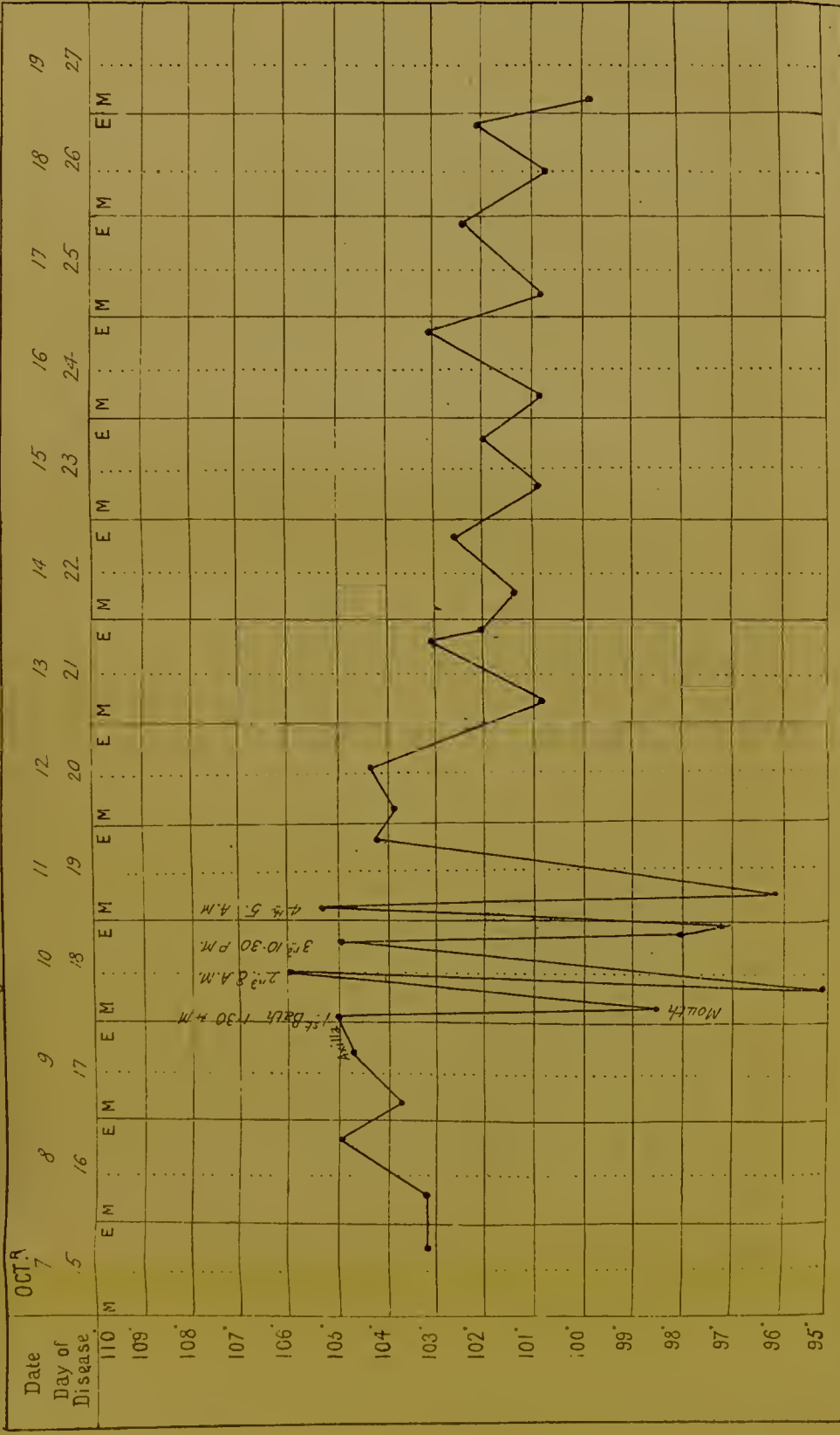
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Plate II.

Name John S

Age 19

Disease Enteric Fever.



Case 8.

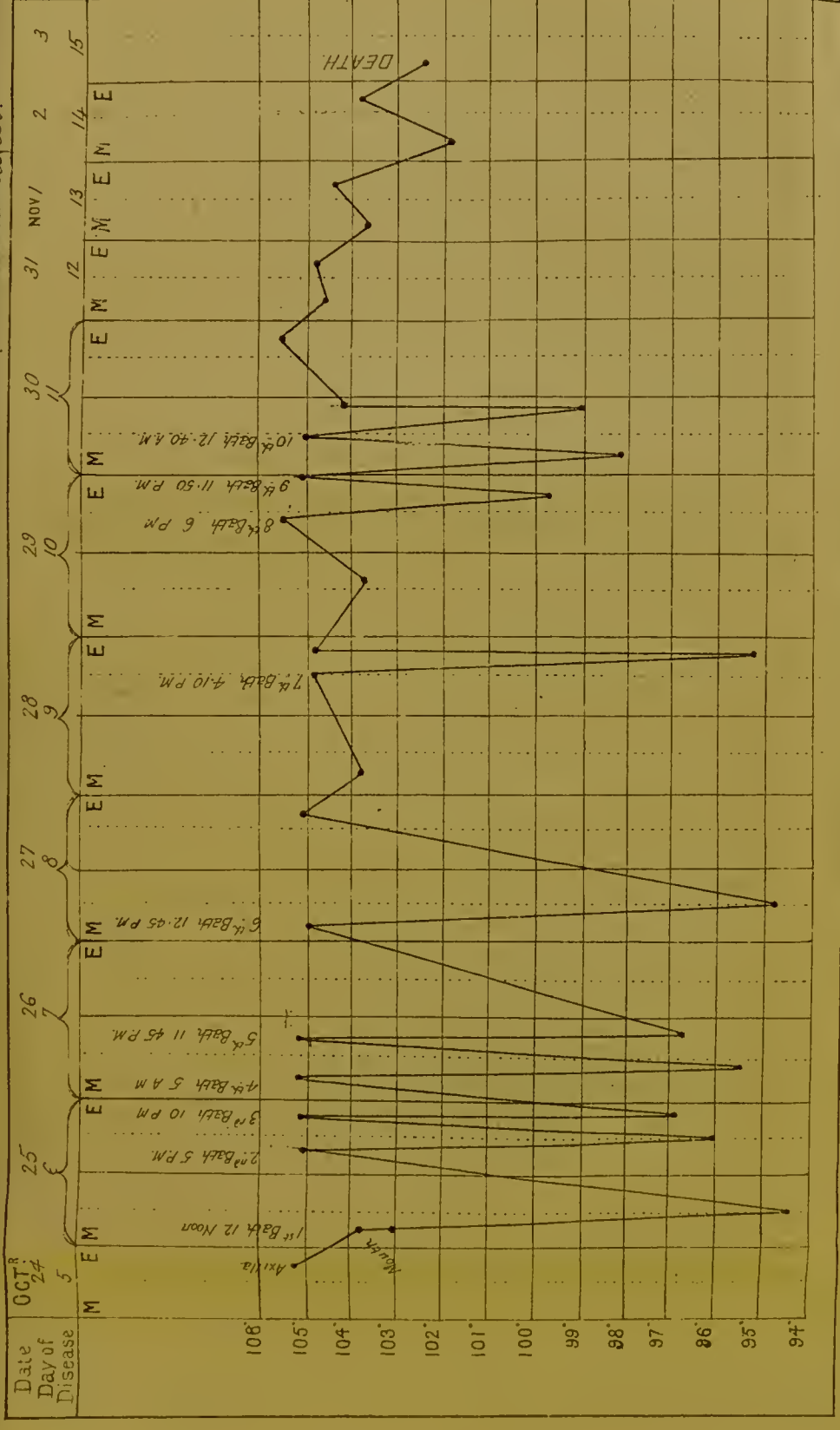
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Plate III

Name *W.M.*

Disease *Enteric Fever*

Occupation *Housekeeper*

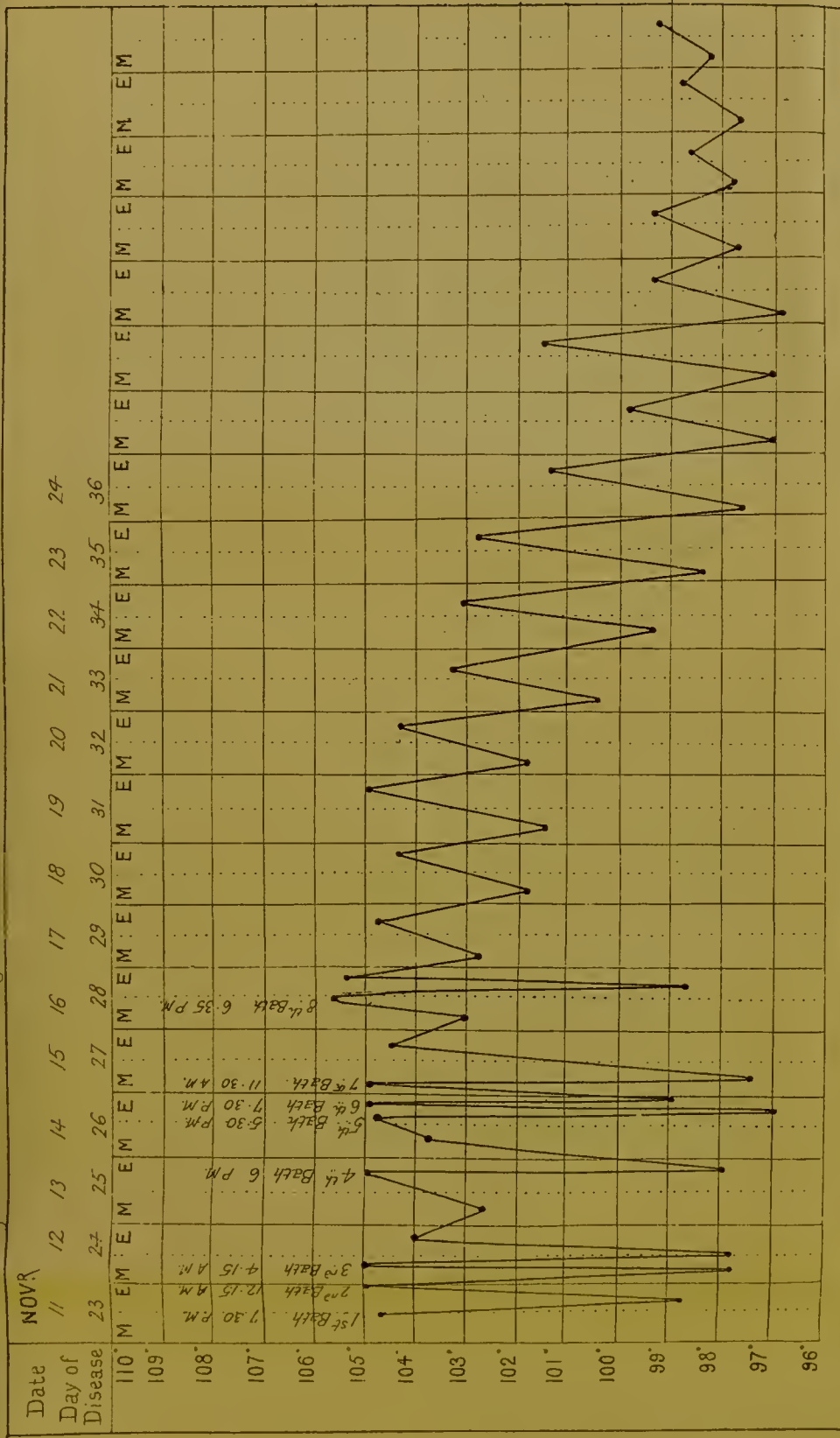


Case 9.

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Plate IV.

Name	Age	Disease	Onset of fever.
Henry J.	Age 11	Disease	Onset of fever.



Case II.

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Plate V.



